JPL PUBLICATION 78-95

(NASA-CR-157841) PARAMETRIC STUDY OF TWO PLANAR HIGH POWER FLEXIBLE SOLAR ARRAY CONCEPTS (Jet Propulsion Lab.) 586 p HC A25/MF A01 CSCL 10A

N79-13501

Unclas G3/44 40837

Parametric Study of Two Planar High Power Flexible Solar Array Concepts

J. A. Garba
D. A. Kudija
B. Zeldin
E. N. Costogue

December 15, 1978

National Aeronautics and Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

JPL PUBLICATION 78-95

(NASA-CR-157841) PARAMETRIC STUDY OF TWO PLANAR HIGH POWER FLEXIBLE SOLAR ARRAY CONCEPTS (Jet Propulsion Lab.) 586 p HC A25/MF A01 CSCL 10A

N79-13501

Unclas G3/44 40837

Parametric Study of Two Planar High Power Flexible Solar Array Concepts

J. A. Garba
D. A. Kudija
B. Zeldin
E. N. Costogue

December 15, 1978

National Aeronautics and Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. JPL Pub. 78-95	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Parametric Study of Two Planar High Power Flexible Array Concepts		5. Report Date December 15, 1978
		6. Performing Organization Code
7. Author(s) J.A. Garba/D. A. Kudija/B. Zeldin/E. N. Costogue		8. Performing Organization Report No.
9. Performing Organization Name and Address JET PROPULSION LABORATORY California Institute of Technology 4800 Oak Grove Drive Pasadena, California 91103		10. Work Unit No.
		11. Contract or Grant No. NAS 7-100
		13. Type of Report and Period Covered JPL Publication
12. Sponsoring Agency Name and Address NATIONAL AERONAUTICS AND SPACE ADMINISTRATION Washington, D.C. 20546		14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

A parametric study to evaluate the effects of mechanical design parameters on the power-to-mass ratio for two high power flexible solar array concepts has been performed. The approach was to perturb the existing design concepts of the 66-W/kg foldout array concept developed by the Lockheed Missiles and Space Company and the 200-W/kg rollout array concept under development of at the General Electric Space Division and to examine the ffects of key mechanical parameters over a wide range of power levels.

The mechanical design parameters of the solar array examined in this study were: frequency, aspect ratio, packaging constraints, and array blanket flatness.

Specific power-to-mass ratios for both solar arrays as a function of array frequency and array width have been developed and plotted. The data plots and computer programs developed can be used as a guide and form a design manual for future solar array designs.

The main body of this report contains summaries of the baseline design data, developed equations, the computer program operation, plots of the parameters, and the process for using the derivations of the parametric equations and computer output for selected power levels.

17. Key Words (Selected by Author(s)) Spacecraft Propulsion and Power Mechanical Engineering Structural Engineering	18. Distribution Statement Unclassified - Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	585	

JPL PUBLICATION 78-95

Parametric Study of Two Planar High Power Flexible Solar Array Concepts

J. A. Garba
D. A. Kudija
B. Zeldin
E. N. Costogue

December 15, 1978

National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

The research described in this publication was carried out by the Jet Propulsion Laboratory, California Institute of Technology, under NASA Contract No NAS7-100

ACKNOWLEDGMENT

The authors gratefully acknowledge the assistance they have received from the following:

Dr. J.C. Chen, who derived the rollout frequency equations and also contributed in the area of flatness criteria; Dr. M. Zak, who investigated the flatness of thin films; Mr. Robert Bamford, for his assistance in the frequency equations; Mr. Robert F. Crawford of AEC-Able Engineering Co., who was responsible for the derivation of the extension mast scaling equations; and Mr. Rodney Badin, who coded the computer programs.

Special thanks is extended to the engineers at the conceptual design contractors for fielding many questions: Dr. Rick Elms at the Lockheed Missiles and Space Company, and Mr. R. Stanhouse at the General Electric Space Division.

ABSTRACT

A parametric study to evaluate the effects of mechanical design parameters on the power-to-mass ratio for two high power flexible solar array concepts has been performed. The approach was to perturb the existing design concepts of the 66-W/kg foldout array concept developed by the Lockheed Missiles and Space Company and the 200-W/kg rollout array concept under development at the General Electric Space Division and to examine the effects of key mechanical parameters over a wide range of power levels.

The mechanical design parameters of the solar array examined in this study were: frequency, aspect ratio, packaging constraints, and array blanket flatness.

Specific power-to-mass ratios for both solar arrays as a function of array frequency and array width have been developed and plotted. The data plots and computer programs developed can be used as a guide and form a design manual for future solar array designs.

The main body of this report contains summaries of the baseline design data, developed equations, the computer program operation, plots of the parameters, and the process for using the information as a design manual. The appendices contain details of the derivations of the parametric equations and computer output for selected power levels.

CONTENTS

CONTENTS (Continued)

CONTENTS (Continued)

CONTENTS (Continued)

CONTENTS (Continued)

I. INTRODUCTION

Development of basic technologies for the design, analysis, hardware development, fabrication, and testing of planar high power flexible solar arrays has been actively pursued by aerospace companies over the last decade. The depth of the development of these technologies varied from feasibility studies to ground testing of prototype hardware and flight testing of flexible rollup solar arrays (FRUSA) by the Air Force. Conceptually, the array designs ranged from semirigid foldable panels to flexible, lightweight, foldable, and rollout designs.

All of these arrays were designed for Earth orbiting applications or tailored for deep space exploration. For both uses the thermal environment is trajectory or orbit and spacecraft dependent, influencing the array operating efficiency.

In recent studies at the Jet Propulsion Laboratory (JPL), the application of flexible solar arrays has centered around missions where these arrays provide the power for solar electric propulsion ion thrusters. Specifically, these solar arrays were used for space vehicles designed for the observation of comets. For such an application the arrays were required to operate at a distance from the sun ranging from 0.6 to 4.5 astronomical units (AU).

Specifically for the Halley's Comet mission, two concepts for the solar array were considered: (1) The foldout concept, developed by the Lockheed Missiles and Space Company (LMSC), under contract to the Marshall Space Flight Center (MSFC) (Refs. 1 and 2), specifically for Solar Electric Propulsion (SEP); and (2) the rollout concept, developed by the General Electric (GE) Space Division, under contract to JPL (Refs. 3 and 4).

Experiences with the adaptation of these two designs to the Halley's Comet mission prompted the Control and Energy Conversion Division at JPL to initiate a parametric study of these two solar arrays performed by the Applied Mechanics Division. The study was to develop parametric data for the mechanical design of these arrays while operating at 1 AU and to derive the equations for their application in other environments. The parameters considered were: natural frequency, array flatness, aspect ratio, and packaging configurations. These characteristics were examined by the mechanisms, structures, and temperature control disciplines. Excluded from this study were the electrical design considerations. This report documents the results of the parametric study and is intended to be used as a design guide for future flexible lightweight solar arrays.

II. OBJECTIVES

The objective of this study was to investigate the effects of a range of mechanical design parameters on the power-to-mass ratio of two specific high power flexible array concepts. The design data for several power levels of each of the two concepts were generated by the respective contractors and were used as the baseline. These baseline data were then perturbed by introducing variations in the parameters.

While the existing designs were studied and checked to better understand the design concepts, the perturbed parametric data are accurate only to the extent of the credibility of the original design.

The variables to be considered were those deemed to be most critical in impacting the solar array mechanical performance characteristics. The effect of changing these variables on the solar array power-to-mass ratio was to be determined.

Specifically, the objectives were to generate data and to develop plots for the solar array specific power-to-mass ratio, at 1 AU, over the power range of 10 to 80 kW per wing in steps of 5 kW for the following characteristics:

(1) Array natural frequency - ranging from 0.005 to 0.04 Hz.

(2) Aspect ratio - length-to-width ratios from 4 to 10.

(3) Packaging features - constraints and attachment approaches.

(4) Solar array blanket flatness - uniform and random between 2 to 10 degrees of arc.

The resulting data and plots were assembled to produce a design guide manual. The design concepts and ranges of the parameters would be applicable to future missions requiring multikilowatt solar arrays.

III. APPROACH

Available design data were used as a basis for this study. For the foldout array concept (66 W/kg), these data were available for power levels of 12.5, 30, and 60 kW/wing. For the rollout array concept (200 W/kg), the data used were for 10.5 and 60 kW/wing.

The approach taken in this study consisted of the following steps:

(1) Review existing data for both concepts. Clarify design features as necessary by contacting contractors.

(2) Define conceptual designs. Document conceptual designs emphasizing modifications, if any. Define mechanisms and structural elements used in the analysis.

(3) Define study constraints. Emphasis on packaging constraints and configurations, and aspect ratio ranges for various power levels.

(4) Conduct thermal analysis of the array. Estimate the temperature ranges of the solar array blankets and the extension mast.

(5) Study flatness criteria. Study the effect of various misalignments and disturbances on the array flatness assuming thin film theory.

(6) Develop weight scaling equations. The scaling equations for the weight of the mechanisms and the structural elements were derived. The scaling equations for the extension mast were developed by a mast manufacturer under contract. The scaling equations were verified against the existing designs.

(7) Develop frequency equations. The frequency equations were reviewed and modified as necessary. Frequency equations were derived for those lacking where the array designer identified these equations as proprietary.

(8) Write computer programs. Computer programs were coded to generate the pertinent parametric data.

(9) Data plots. Pertinent data of the study are summarized by plots.

IV. ORGANIZATION OF REPORT

Since some of the material produced by the study is voluminous and may not be of general interest, the report is divided into several parts, the main body and six appendices. The main report is a summary of the study to develop the baseline data, the equations, and the plots for the parameters and the conclusions. The appendices contain all of the detailed data, such as equation derivations and computer outputs. Some of these data are informal.

V. BASELINE CONFIGURATIONS

The baseline data used were obtained from design studies performed by the contractors of the respective array concepts. The existing designs were studied and some minor modifications made as appropriate for this study. All modifications to the original data are noted. The detailed weight data are contained in Appendix A.

A. FOLDOUT ARRAY

The foldout array designs are described in detail in Refs. 1 and 2. Highlights of the design are summarized below. The pertinent data for the foldout conceptual designs are listed in Table 1.

1. General Description

The foldout concept developed by the Marshall Space Flight Center/Lockheed Missiles and Space Company array (Fig. 1) consists of a flat folded array blanket, a containment box for launch support of the stored blanket and extension/retraction mast, and a blanket tensioning system that operates with the mast stiffness to provide extended wing natural frequency control.

Table 1. Baseline Data for Foldout Array Concepts (supplied by LMSC)

Item	12.5 kW/wing	30 kW/wing	60 kW/wing
Blanket power density, kW/m^2	0.0989	0.119	0.118
Blanket mass density, kg/m^2	0.895	0.355	0.344
Array length, m	31.6	31.9	51.0
Array width, m	4.0	8.0	10.1
Blanket tension, newtons	98.0	13.0	22.0
Mast diameter, m	0.37	0.18	0.23
Mast stiffness, newton-m^2	0.63×10^5	0.044×10^5	0.28×10^5
Array frequency, Hz	0.04	0.017	0.017

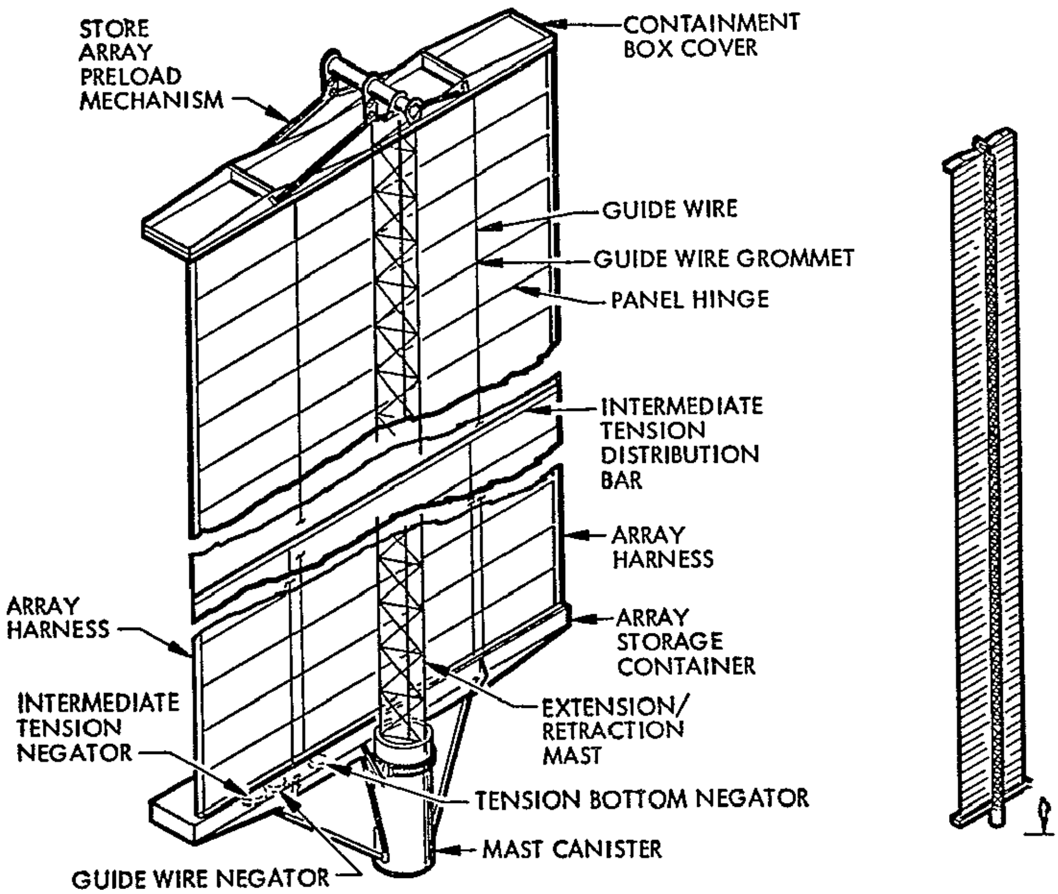


Figure 1. Foldout Array Concept

The mast is behind the blanket which shades the mast from the sun. Since the mast is behind the blanket, a moment load is applied to the mast. Although this moment loading is of little consequence at low power levels, it causes increases in mast weight as longer masts and higher tension is used.

2. Array Blanket

The solar array blanket is a laminated substrate consisting of the following layers: 25-micron Kapton, 12.5-micron adhesive, copper interconnect, 25-micron Kapton, and 200-micron solar cell with 150-micron fused silica cover glass. The blanket is divided into panels. The appropriate number of panels are hinged together with a fiberglass piano hinge to obtain the desired blanket length. For stowage the blanket is folded accordion style into the array containment box.

Padding is placed between the cells on each panel to prevent the solar cells from scuffing the cells on the facing panel during stowage. The padding also helps to keep the blanket from sliding during launch vibration.

3. Array Containment Box and Cover.

For protection during launch vibration, the array blanket is folded into the array containment box and compressed between the cover and bottom of the box. Compression is used to prevent the blanket from sliding from side to side, thus avoiding cell damage. For a 31-meter long folded blanket, a 10,342-newton/m preload is required.

Also housed within the array containment box are the blanket tensioning mechanisms.

The array containment box and cover are constructed of aluminum honeycomb with graphite epoxy skins.

4. Containment Box Latch

For the purposes of this study the containment box latch has been changed from that used on the MSFC/LMSC array to eliminate the relatching capability. Rather than using only four tiedown points to hold the cover down, a cable is used which allows a tiedown point at 0.45-meter intervals along the length of the box.

At each cover tiedown point the cable is spring-loaded to release when the cable tension is reduced. The end of the cable is held by a pinpuller which is fired to initiate deployment.

This new latch allows the cover and box to be lighter because the latch distributes the blanket preload, rather than the structure of the box and cover. The blanket can still be fully retracted but cannot be relatched for Earth return as the MSFC/LMSC latch concept would permit.

5. Array Mast

The foldout array uses a coilable, continuous longeron S-glass polyimide mast.

The blanket is between the sun and the mast and does not require shielding from the sun. The mast can withstand temperatures of 300°C.

6. Mast Canister

The mast canister is a cylindrical graphite epoxy tube into which the mast is coiled for stowage. The top half of the canister contains a motorized nut through which the mast is deployed/retracted.

7. Tensioning Mechanisms

The tensioning mechanisms consist of a negator spring motor and a spool of wire. The negator spring motor provides a near constant torque to the wire spool as the wire is fed out during array deployment.

Three pairs of tensioning mechanisms are housed in the array containment box. The ends of the wires on one pair attach to the array containment box cover.

The wires from another pair attach to the midtension bar to hold the blanket flat during intermediate deployments. The third pair of tensioning mechanisms attach to the bottom of the blanket to provide blanket tension during full deployment.

8. Array Folding Hardware

If the width of the array becomes wider than 4 meters, it will become necessary to reduce the stowed width by folding the array containment box. To do this, monoball hinges, rotary deployment actuators, and latches were added to the MSFC/LMSC array design.

9. Stowed Configuration

The stowage configuration for a interplanetary spacecraft using the unbroken foldout array is shown in Fig. 2. The array is folded so that the array containment box is between the thrusters and the Shuttle Orbiter Interim Upper Stage (IUS), and the canister is folded along the power processors.

If the array becomes wider than 4 meters, it will no longer fit across the shuttle bay. At this point the array containment box must be broken into three sections and folded around the power processors.

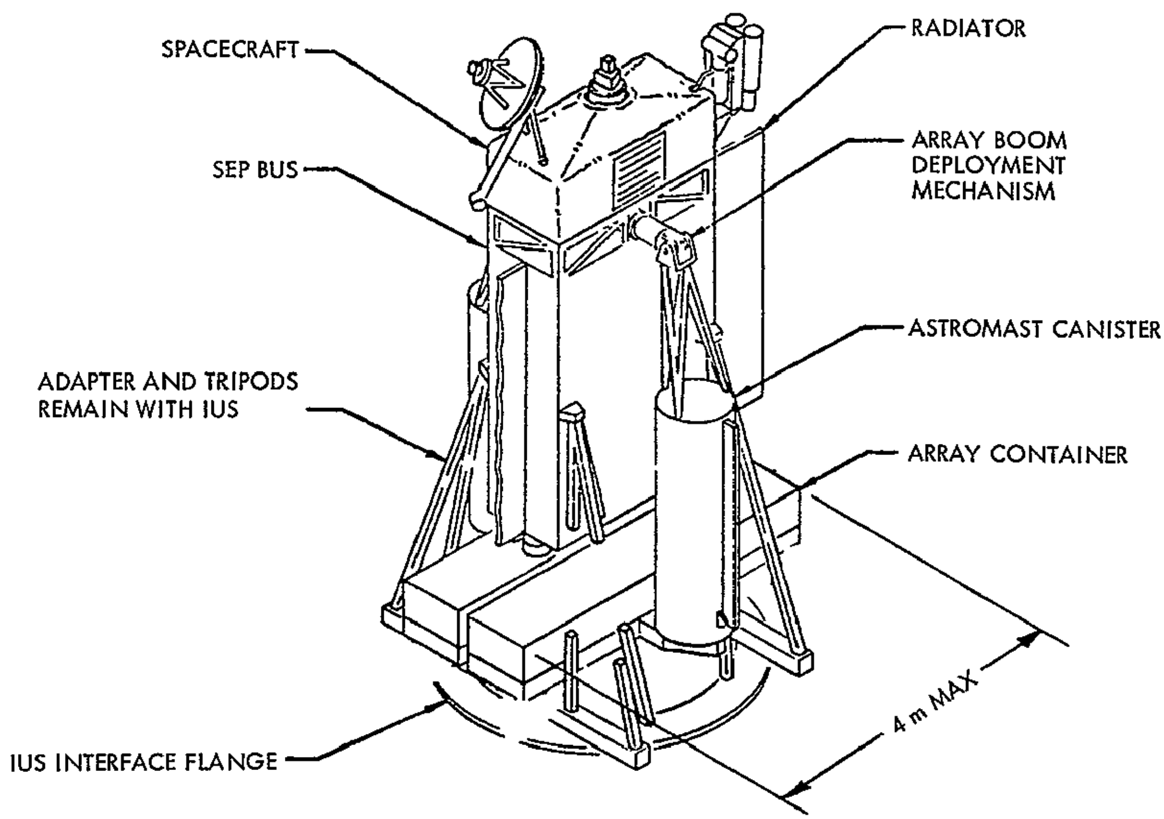


Figure 2. Foldout Array Unbroken Stowage Configuration

The broken foldout array is shown in Fig. 3. After separation for the IUS, the solar array position boom is deployed and the array containment box is unfolded (Fig. 3). The solar array is then ready for blanket deployment.

10. Array Weight

Appendix A contains two sets of array weights, those supplied by LMSC in Refs. 1 and 2, as well as the array weights as estimated by JPL. The latter includes the effect of the modifications.

B. ROLLOUT ARRAY

The rollout array design is described in detail in Refs. 3 and 4. Highlights of the rollout solar array design are summarized below. The pertinent data for the rollout designs are listed in Table 2.

1. General Description

The baseline solar array is a fully retractable, rollout design consisting of two flexible solar blankets in a "V-stiffened" configuration. The solar array blanket consists of a substrate of 25-micron Kapton-F, 50-micron solar cells and 75-micron FEP-Teflon as the coversheet. FEP-Teflon is a thermoplastic that may be heat sealed to the cells and interconnects, without the necessity of a cement.

The two flexible solar blankets are stowed on two 30.5-cm diameter cylindrical drums.

One of the salient features of this design is the utilization of in-plane stiffness inherent in the blanket construction as indicated in Fig. 4. Approximately 1/3 of the required boom stiffness is obtained from the "V"-stiffened blanket. With a lower requirement on boom stiffness, the boom mass may be reduced accordingly. The coilable lattice continuous longeron boom was selected for the best mass-to-stiffness ratio, relatively low sensitivity to thermal-induced bending, and low backlash characteristics.

For arrays more than 4 meters wide, the two drums are folded as shown in Fig. 5.

2. Flexible Solar Blankets

The 50-micron 2 × 2-cm cells are held to a 25-micron Kapton substrate with 13 micron RTV thermoplastic adhesive. The cells are interconnected with 25-micron thick molybdenum and are covered with 75-micron plastic encapsulant.

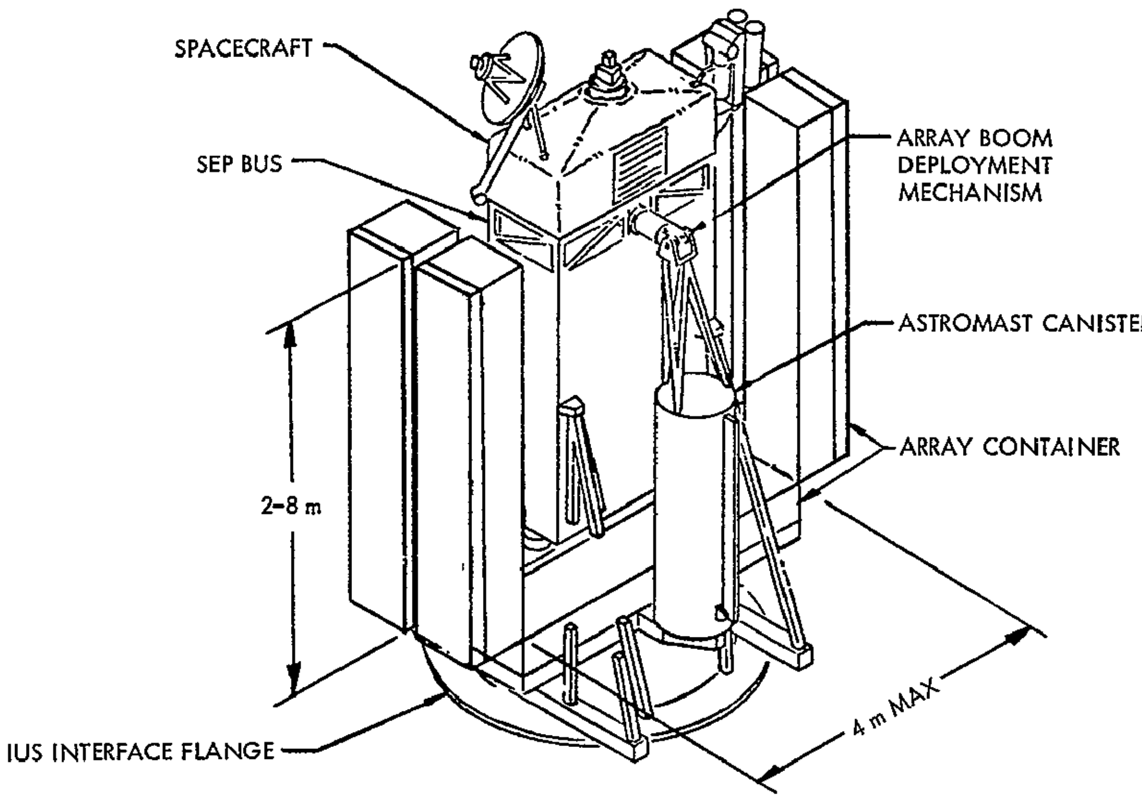


Figure 3. Foldout Array Broken Stowage Configuration

Table 2. Baseline Data for Rollout Array Concepts (supplied by GE)

Item	10.5 kW/wing	60 kW/wing
Blanket power density, kW/m^2	0.139	0.130
Blanket mass density, kg/m^2	0.368	0.313
Array length, m	17.2	60.5
Array width, m	4.7	8.4
Tension per blanket, newtons	7.1	122.8
Mass diameter, m	0.12	0.50
Mast stiffness, newton-m^2	0.532×10^3	149.0×10^3
Cant angle, degrees	8.0	3.0
Array frequency, Hz	0.04	0.04

3. Shaft

The shaft is the structural tie between the drum and the center support. On the outboard end of the shaft mount, the negator spring motor and the slip ring assembly are mounted. For arrays under 4 meters in width, the shaft mounts to the center support through a flange; for arrays over 4 meters wide, the connection between the shaft and center support is through a hinge to allow the drums to fold for stowage. The shaft is constructed of aluminum and contains seats for two sets of bearings to provide for the rotation of the drum.

4. Drum

The drum is a 30.5-cm diameter graphite epoxy cylinder upon which the solar array blanket is rolled for stowage.

To remove the blanket from the drum, the mast is extended, and the blanket rolls off the drum similar to a window shade. To retract the array, the mast is retracted, and the negator spring motor rotates the drum to take up the blanket.

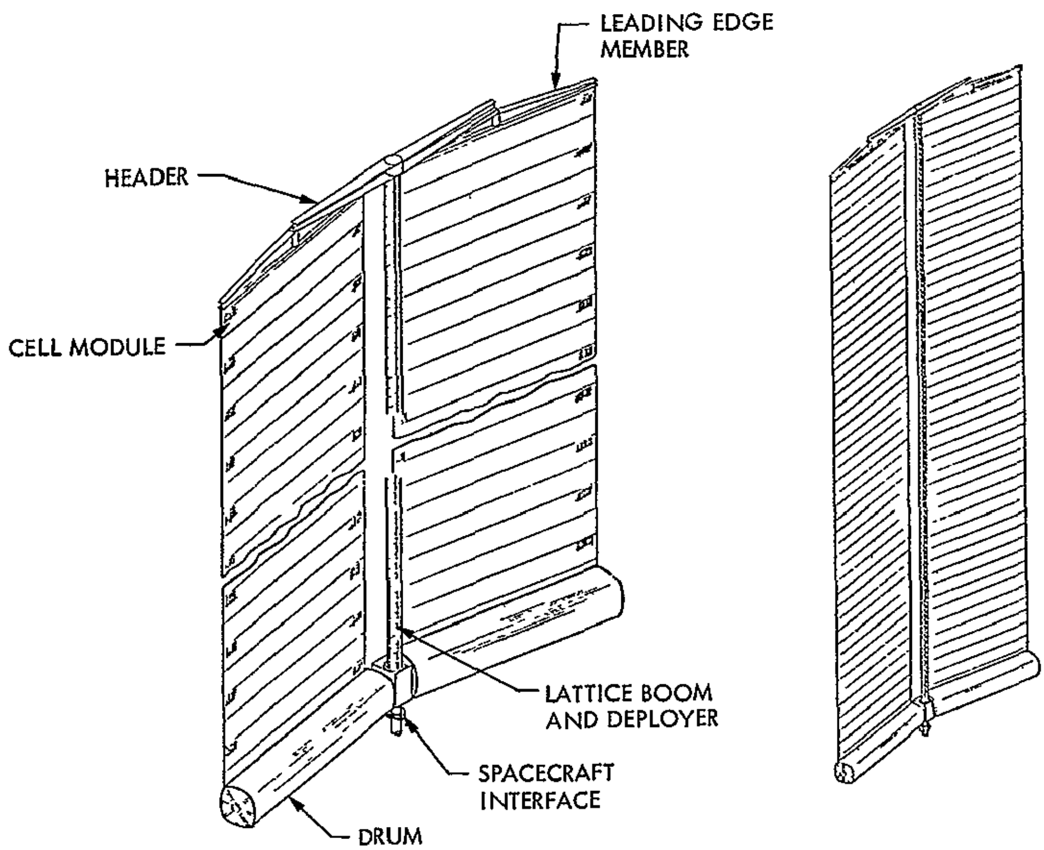


Figure 4. Rollout Array Concept

ORIGINAL PAGE IS
OF POOR QUALITY

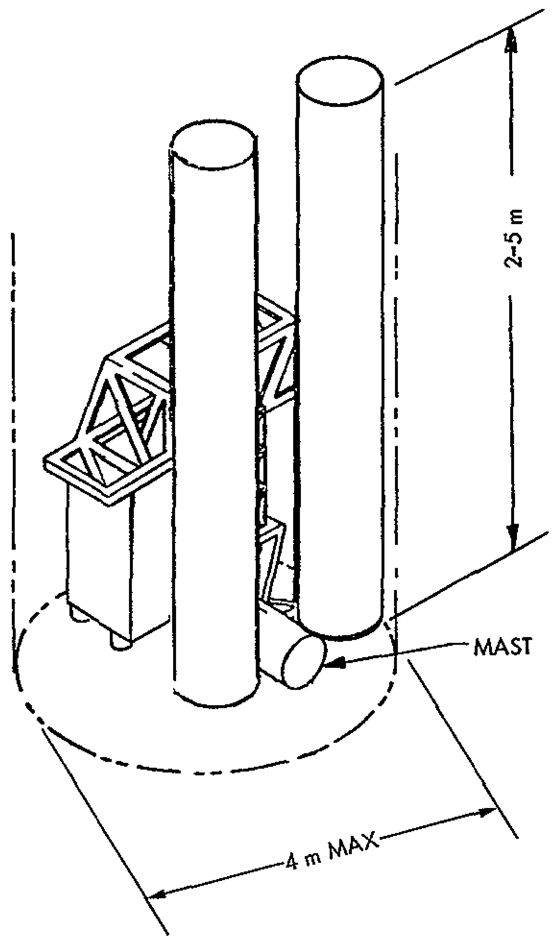


Figure 5. Rollout Solar Array Stowage Configuration

5. Negator Spring Motor

The negator spring motor provides a near constant torque to the drum to retract and tension the solar array blanket.

The negator motor has several negator springs that are wound around the shaft during stowage. When the array is deployed, the negator springs are wound around take-up spools on the drum and provide the blanket tensioning force.

The 10.5-kW array was designed to use negator springs to provide retraction force only. The tension force was obtained by locking the drums so that they cannot rotate and extend the mast until a coil spring in the mast tip fitting compresses enough to give the required tension.

For the purposes of this study, it was assumed that the negator springs provide retraction and tension forces for all GE arrays.

6. Center Support

The center support is the structural tie between the two drums and the array mast canister. The center support is an aluminum structure and also provides the spacecraft mounting interface.

7. Array Mast

The array mast is a coilable, continuous longeron mast. For deployment and retraction the mast is driven by its motorized canister. The array mast is constructed of S-glass/polyimide material.

A modification that has been made to the array mast for the purpose of this study is the addition of a 25-micron thick aluminized Teflon sleeve around the mast. As designed, the mast is fully exposed to the sun. While this is not a problem at 1 AU or greater, as the mast moves closer to the sun it becomes necessary to shade the mast or lose a significant portion of its strength. The addition of this sleeve will allow the array to approach 0.3 AU.

8. Header

The header is the structure that connects the array mast to the outer end of the array blanket.

The header is a graphite epoxy beam connected in the middle to the end of the array mast, and a leading edge member connected to each end.

9. Leading Edge Member

The leading edge member is a graphite epoxy beam which takes the load applied to it at one point by the header and distributes it uniformly across the blanket.

10. Drum Folding Hardware

This study assumes that arrays wider than 4 meters can be folded to allow them to fit across the shuttle bay. To enable the drums to be folded, a hinge and an actuator must be added between the drum and the center support.

The hinge is a clevis-monoball similar to the Viking solar panel hinge. The actuator is a linear gas generating squib.

11. Modifications

For the purpose of this study the following changes have been made in the rollout array:

(1) A protective reflective sleeve around the mast has been added for thermal control.

(2) The tension spring on the 10-kW/wing array has been removed.

12. Array Weight

The rollout array weights for the conceptual designs are listed in Appendix A. This appendix contains the weights as originally predicted by GE and also the JPL estimates which account for the effect of the modifications.

C. BLANKET PROPERTIES USED IN THE PARAMETRIC STUDY

The basic properties of the solar array blanket are different for the two solar array designs. The data used in the parametric study for the foldout and rollout solar array are listed in Table 3.

Table 3. Specific Values Used for Parametric Study

Item	Foldout array	Rollout array
Blanket power density, kW/m^2	0.0989	0.139
Blanket mass density, kg/m^2	0.895	0.368

VI. DEFINITION OF PARAMETERS

The parameters analyzed in this study were array frequency, aspect ratio, packaging constraints, and solar array flatness. Frequency and aspect ratio have specific values. Packaging constraints and solar array flatness are parameters where a specific value cannot be assigned. The parameter values used in this study are defined in this section.

A. FLATNESS CRITERIA

In generating a design specification for a solar array structure, it is required to relate the structural and mechanical design to the performance or power output of the array. To maximize the power output the structure should provide support to the solar cell assemblies such that the number of cells perpendicular to the solar irradiance will be maximized.

Typically, blanket flatness is specified as "uniform and random between 2 to 10 degrees." In order to be able to study the flatness requirement in a quantitative way, the task was divided into three parts. First, inquiries were made about the importance of flatness and the criteria for determining flatness for some of the arrays which have flown. Second, the causes and effects of array out of flatness were studied and analytical expressions for the power loss due to these causes were developed. Many simplifying assumptions had to be made in this area. Third, these expressions were to be used in the parametric study to include the effect of the various disturbances on the array power loss.

The first task produced no quantitative answers. Flexible solar arrays that have flown to date were not evaluated for flatness and the non-flatness did not seem to be of any concern.

The second task consisted of defining the causes for the flexible solar array non-flatness. The effects were classified as overall or global deformation and local effects.

The following is a list of possible conditions causing the solar array blanket to deviate from a flat surface:

(1) Deformations due to gravity or uniform pressure loading. This is a global effect caused by the acceleration field produced by the ion drive propulsion and solar pressure. The loading is assumed perpendicular to the surface of the array.

(2) Deformations due to thermal effects. Thermal effects can cause both global and local deformations.

(3) Variation of tension across the width of the solar array blanket.

(4) Film wrinkling due to the gravity component acting in the plane of the solar array blanket. This is a local effect which applies to the V-stiffened solar array or to a solar array revolving in the gravity field.

(5) Surface wrinkling due to support misalignment. Three types of misalignment are considered, non-parallel supports in-plane and out-of-plane, as well as a parallel shift of the supports.

(6) Manufacturing effects. Local deformations due to initial imperfections of the membrane. This effect was addressed only for the foldout frame type subpanel.

The effect of the above have been translated into structural deformations and ultimately into power loss by analytical derivations. In deriving these expressions, certain simplifying assumptions had to be made. Since no test data are available for structural samples representative of the blanket construction, the hypothesis of these assumptions will have to be tested at a later date, when such data becomes available. This subject is discussed further in Section XIII as an area needing further investigation.

In deriving the expressions for flatness criteria and power loss, the following assumptions have been made:

(1) An ideal thin film has been assumed in all equations. Blanket stiffening due to the solar cells and wiring has been neglected. The importance of some of these effects is not known at this time. This area has been identified as requiring additional investigation. The blanket has been assumed to have homogeneous, uniform properties. Wherever necessary the structural and thermal properties of Kapton were used.

(2) Linear variations of temperature and tension across the width were assumed wherever applicable.

(3) The effects of blanket imperfections due to manufacturing were related to the blanket thickness.

(4) All expressions for power loss have been derived using the disturbances or misalignments.

The derivations of structural deformations and power loss are included in Appendix B. Table 4 summarizes the estimated power loss due to the various causes. For each design the maximum power loss in percent is given for 1 AU operation. Based on the results shown in

Table 4, flatness considerations were eliminated from this parametric study. It should again be emphasized that the justification for such a decision was derived from the assumptions used in the study.

B. ASPECT RATIO

The array aspect ratio, or the ratio of length to width, was specified as a parameter to be used in this study. Since the width of the solar array is an important parameter in defining packaging constraints, the width of the solar array was chosen as an independent parameter, and the aspect ratio as a dependent parameter, in this study. Whenever a solar array width is quoted for a given power level per wing, the aspect ratio is a fixed value for that width.

Table 4. Estimated Power Loss for the Foldout and Rollout Concepts at 1 AU

Cause	Assumed value	Power loss, %	
		Foldout	Rollout
Solar pressure	1.6×10^{-3} psi	0*	0
Acceleration	1×10^{-3} g	0.1	0.001
Temperature @ 1 AU			
Uniform expansion	T @ 1 AU	0.5	0.8
Variation across width	ΔT @ 1 AU	0.2	0.2
Boom distortion	ΔT @ 1 AU	0	0
Non-parallel supports			
In plane	1°	0	0
Out of plane	1°	0.4	0.4
Shift	1°	0.001	0.001
Manufacturing effects	20 times film thickness	0	---

*Values of less than 0.001% are quoted as zero.

C. PACKAGING CONSTRAINTS

The packaging of the solar array is most strongly influenced by the shuttle orbiter dynamic envelope and by structural configurations which are highly mission dependent. The Shuttle Orbiter dynamic envelope provides a logical quantitative constraint which was used in this study. Solar arrays under 4 meters in width were considered unbroken or not folded along the width because of containment within the Shuttle Orbiter envelope. Solar arrays above 4 meters in width were considered broken, requiring additional mechanization and structure for folding the stowage solar arrays. Typical stowage configurations are shown in Figs. 2, 3, and 5. In order to satisfy the spacecraft constraint, data for a series of parameters were generated and are presented in this report either in equation form or as detailed computer printouts. The data are intended as a guide for the spacecraft configuration or systems design. The following parameters were studied:

(1) Deployable boom canister volume

  (a) Length

  (b) Diameter

(2) Solar array storage volume

  (a) Width

  (b) Length

  (c) Height

The solar array storage width is an independent parameter discussed earlier as part of the aspect ratio. The solar array length in this context is determined by the panel width, such as the container width for the foldout, and the drum diameter plus blanket for the rollout.

Data for the deployable boom canister length and diameter were obtained from the manufacturer.

D. FREQUENCY

The array frequency is calculated assuming the solar array to be fixed at the base of the solar array/position boom interface. Because the position boom length is mission dependent, this variable has been eliminated from the study. Since the frequency requirement usually includes the effect of the position boom, simplified relationships for sizing the boom to meet a specified frequency were developed.

In deriving the frequency equation for both solar array concepts, solar array bending and solar array torsion or twist were considered. All frequency calculations are based on a Rayleigh-Ritz method. For the foldout solar array, the equations developed in Ref. 5 were used with some minor modifications, as proposed by LMSC. For the rollout solar array, the equations developed in Ref. 5 were modified to account for the shape function of the extension mast. For the rollout solar array this shape function is different due to the moment constraint provided by the V-stiffened design.

VII. THERMAL ANALYSES

The thermal analyses performed in support of this study were aimed at providing temperature level and temperature distribution of the extensible array boom elements and of the solar array cell blankets. While the current study focuses on solar array performance at a heliocentric distance of 1 AU, the thermal studies were extended to cover the range of 0.3 to 0.5 AU. A summary of the analyses and data are contained in Appendix C.

A. THERMAL ANALYSES OF THE EXTENSIBLE BOOMS

1. Foldout Solar Array

In the foldout solar array concept, the mast is shaded from the sun by the solar cell blanket. The boom temperature at 1 AU is estimated at $-41^{\circ}C$. An estimate of ΔT, the temperature variations between longerons, is $2-6^{\circ}C$ depending upon cell blanket width (a wider blanket has a smaller ΔT). Details of this analysis are contained in Section I-A of Appendix C.

2. Rollout Solar Array

A cursory thermal analysis of the GE rollout solar array concept indicates the potential for excessive temperature differences between elements of the extensible mast. Such temperature differences could exceed $100^{\circ}C$ at 0.3 AU. To avoid such a condition, it was decided to consider the effect of a thermal sleeve around the mast. An analysis assuming such a sleeve indicates that temperature differences between longerons at 1 AU can be reduced to about $11^{\circ}C$ or less. See Section I-B of Appendix C for the derivation and a summary of the data for various heliocentric distances.

B. THERMAL ANALYSES OF THE SOLAR CELL BLANKETS

Temperature level for the solar cell blankets has been generated as well as temperature deviation resulting from non-flatness.

1. Foldout Solar Array

At a heliocentric distance of 1 AU, the blanket temperature is predicted at approximately 46°C. The current LMSC blanket design has the solar cell thermally conducting to the Kapton substrate through the four weld points to the interconnects. The analysis presented here assumes intimate conductive contact between cell and substrate, which leads to solar cell temperature predictions that are somewhat lower than would be achieved in practice. Depending on the radiation patterns of the solar cell to the Kapton substrate, temperatures in excess of 80°C can be expected. Deviations from this value due to local non-flatness, even when this deviation is as high as 10 degrees of arc is only about 1°C. Appendix C, Section II-A, contains a detailed discussion and data for the foldout array temperatures versus heliocentric distance, temperature control strategies, and the effect of non-flatness. The effect of non-flatness is negligible at 1 AU but becomes very important at heliocentric distances less than 0.6 AU.

2. Rollout Solar Array

For the GE rollout concept, the blanket temperature level predicted at 1 AU is 55°C. Deviation from this value due to local non-flatness, even when such deviation reaches 10 degrees of arc, is less than 4°C. The rollout array, because of the V-stiffening, has some peculiar thermal problems at heliocentric distances less than 0.7 AU. The local non-flatness becomes very important at small heliocentric distances, mainly because of the required angle of rotation of the array to keep the cell temperatures at an acceptable level.

A detailed discussion of the effect of non-flatness and required array rotation on the temperature of the blanket is contained in Appendix C, Section II. This section also contains temperature data for various heliocentric distances between 0.3 to 5.0 AU and local out of flatness of 0.1 to 10.0 degrees of arc.

In a supplemental analysis, it is shown that temperature non-uniformity induced solely by V-stiffened geometry is negligible at heliocentric distances not requiring array rotation.

VIII. DEVELOPMENT OF PARAMETRIC EQUATIONS

A. WEIGHT SCALING EQUATIONS

The weight scaling equations are derived using the baseline configurations of both designs as the fundamental data points for extrapolation. Typically, scaling laws were derived which required the evaluation of constants. These constants were determined by applying the scaling laws to the existing designs, as documented in Refs. 1 through 4; details of the derivation of the weight scaling equations are contained in Appendix D, Section I.

1. Scaling Laws for the Weights of the Structural Elements

The structural elements were scaled based on the function of elements. In developing the scaling equations, it was assumed that the elements were either stress, deflection, or buckling critical. The structural elements were analyzed for loading during spacecraft launch, and in the deployed cruise condition. Wherever it was not clear which condition was governing, the larger of the two calculated weights was used.

In the derivation of all scaling equations, it was assumed that the baseline designs are structurally adequate for both the launch as well as the cruise environment.

a. Weight Scaling Data for the Coilable Lattice Boom and Canister. The coilable lattice boom used for the LMSC foldout solar array was designed by the AEC-Able Engineering Co. of Goleta, California. The coilable boom design was based on the requirement to meet a packaging volume constraint and constant longeron strain. The scaling equations for this boom are derived in Appendix D, Section I, Part 1. Only the pertinent equations will be listed here as they relate to boom and canister weight. The scaling constants for this boom were determined from the actual hardware which was built by Able Engineering Co. for LMSC. It is assumed that the longeron and batten members are made of solid, circular, initially straight rods of S-glass/epoxy material for a required boom stiffness $\overline{EI}$. The boom mass per unit length is given as

$$\frac{M_B}{L} = 2.30 \times 10^{-3} \sqrt{\overline{EI}} \tag{1}$$

where

M_B = boom mass, kg

L = boom length, m

$\overline{EI}$ = bending stiffness, newton-m^2

The boom bending stiffness and the boom radius are related by

$$\overline{EI} = 5.192 \times 10^7 R^4 \tag{2}$$

where R is the radius in meters. The canister mass is then given as

$$M_C = 0.367LR + 389.6R^2 \tag{3}$$

where M_C is the canister mass in kilograms.

The coilable lattice boom used for the GE rollout solar array was designed by the Astro Research Corp. and was directed to minimize the system mass M_S, where the system mass was defined as the sum of the boom mass M_B and the canister mass M_C.

The scaling equations for the rollout type boom have been derived by AEC-Able Engineering Co. and are documented in Appendix D, Section I, Part 2. All assumptions in this derivation are clearly stated.

The system mass in kilograms is given by

$$M_S = 3.17 \times 10^{-7} \frac{\overline{EI} \cdot L}{R^2} + 1.343 \times 10^{-6} \frac{\sqrt{\overline{EI}}}{R}$$

$$+ \frac{28.675R^2}{\sqrt{2\left(8261.1 \frac{R^2}{\sqrt{\overline{EI}}} - 1\right)}} + 336.7R^2 \tag{4}$$

where all the quantities have been defined previously. For a given application, namely, a given $\overline{EI}$ and L, Eq. (4) is used to find R such that M_S is minimized. Then the boom and canister masses are given by

$$M_B = 3.17 \times 10^{-7} \frac{\overline{EI} \cdot L}{\bar{R}^2} \tag{5}$$

and

$$M_C = 1.343 \times 10^{-6} \frac{\sqrt{\overline{EI}}}{\overline{R}} + \frac{28.675\overline{R}^2}{\sqrt{2\left(8261.6 \frac{\overline{R}^2}{\sqrt{\overline{EI}}} - 1\right)}} + 336.7\overline{R}^2 \tag{6}$$

where $\overline{R}$ is the boom radius corresponding to a minimum M_S.

b. Weight Scaling Equations for Other Structural Elements. The remaining structural element weights have been scaled, based on their function.

Scaling equations have been developed for the box cover, the container, the mast tip fitting, the support struts, and the box hinge structure for the foldout configuration. For the rollout conceptual design, these equations have been derived for the drum, the shaft, the center support, the header, the leading edge member, and the folding structure. These equations are numerous and their derivations, including the assumptions that lead to these equations, are documented in Appendix D, Section I, Part 3. In general, for the foldout solar arrays, the structural component weights can be expressed in a functional notation as

$$W_i^{SF} = f_S(\ell_B, w_B, \gamma_A) \tag{7}$$

where

ℓ_B = blanket length

w_B = blanket width

W_i^{SF} = weight of the ith structural element of the foldout configuration

γ_A = blanket weight density

and f_S denotes a function.

For the rollout solar arrays, a similar functional relationship can be written as

$$W_i^{SR} = g_S(F_D, \ell_B, w_B, \gamma_A) \tag{8}$$

where

F_D = blanket tension

W_i^{SR} = weight of the ith structural element of the rollout configuration

All other quantities are the same as in Eq. (7), and g_S denotes a function.

2. Scaling Laws for the Weights of the Mechanisms

The scaling equations for the mechanisms have been derived using the weight data supplied for the conceptual designs, documented in Refs. 1 through 4.

Some weights of the mechanisms scaled linearly, others required a nonlinear relationship, depending on the type of mechanism and its application. A small number of mechanisms were assumed to have constant weight throughout this study. The derivations of the mechanism scaling laws are contained in Appendix D, Section I, Part 4.

For the foldout solar array, a general functional relationship for scaling the mechanism weights can be written as

$$W_i^{MF} = f_M(A, \ell_B, P, T, w_B, \gamma_A) \tag{9}$$

where

W_i^{MF} = weight of the ith mechanism of the foldout configuration

A = attachment point of intermediate tension distribution bar

P = total wing power output

T = blanket tension distribution

f_M denotes a function and all other quantities are the same as in Eqs. (7) and (8).

For the rollout solar array, a similar relationship can be written as

$$W_i^{MR} = g_M(F_D, \ell_B, R_D, \bar{R}, P) \tag{10}$$

where

W_i^{MR} = weight of the ith mechanism of the rollout configuration

R_D = drum radius

and all other quantities have been defined previously in Eqs. (1) through (9). Here, again, g_M denotes a functional relationship.

B. FREQUENCY SCALING EQUATIONS

The frequency scaling equations for both designs were derived using a Rayleigh-Ritz energy approach. The lowest frequency of the first bending mode and of the first torsion mode was sought. The detailed derivations of the frequency equations are contained in Appendix D, Section II.

1. Frequency Equations for the LMSC Foldout Solar Array

a. Lowest Bending Mode. The frequency of the lowest bending mode of the foldout solar array is obtained by first deriving an equation for the energy balance. The approach suggested by LMSC was followed throughout. To minimize the boom weight, a minimum boom bending stiffness, $\overline{EI}$, with respect to blanket tension is sought. Thus, using the equation for energy balance, the condition

$$\frac{d(\overline{EI})}{dT} = 0 \tag{11}$$

is imposed. The following relationships can then be derived:

$$T = f_T(\omega_B, \sigma', L) \tag{12}$$

and

$$\overline{EI} = f_E(\omega_B, \sigma', L, \rho', M_{OB}) \tag{13}$$

where

L = boom length

M_{OB} = outboard mass

T = total blanket tension

ρ' = boom mass density/length

σ' = array mass density/length

ω_B = circular bending frequency

b. Lowest Torsion Mode. The frequency of the lowest torsion mode is estimated using a similar procedure:

$$\omega_T = g_T(L, I_{OB}, \sigma_0, T', \overline{GJ}, s) \tag{14}$$

where

$\overline{GJ}$ = boom torsional stiffness

I_{OB} = outboard mass moment of inertia about boom axis

s = array half-width

T' = blanket tension/width

σ_0 = blanket mass density/unit area

ω_T = circular torsion frequency

and g_T defines a functional relationship.

2. Frequency Equations for the GE Rollout Solar Array

The derivation of the frequency equations for the GE rollout solar array follows the same approach as that used for the foldout. An additional complication introduced in the rollout concept is the boom deflected shape due to the tip restraint provided by the V-shaped blanket configuration. The derivation of the deflected boom shape is based on experimental data supplied by GE (Ref. 6).

a. Lowest Bending Mode. The frequency of the lowest bending mode is determined from the solution of the following cubic equation:

$$A_1\lambda^3 + A_2\lambda^2 = A_3\lambda + A_4 = 0 \tag{15}$$

where

$\lambda = \omega_B^2$

$\gamma = \sqrt{\dfrac{T}{\overline{EI}}}$

$A_1 = f_1(M_A, M_{OB}, M_B, \gamma, \ell_B, A, B, K_R)$

$A_2 = f_2(M_A, M_{OB}, M_B, \gamma, \ell_B, A, B, K_R)$

$A_3 = f_3(M_A, M_{OB}, M_B, \gamma, \ell_B, A, B, K_R)$

$A_4 = f_4(M_A, \gamma, \ell_B)$

and

M_A = array mass

M_B = boom mass

M_{OB} = outboard mass

A, B = constants determined from the boom differential equation using a prescribed tip restraint

K_R = boom root rotational spring constant

ℓ_B = boom length

T = total blanket tension, both sides

$\overline{EI}$ = boom stiffness

ω_B = circular bending frequency

γ = boom parameter relating blanket tension to boom bending stiffness

and f_1 through f_4 indicate functional relationships. All of the above quantities must be defined in consistent units. Equation (15) must be solved for a particular configuration and a prescribed γ.

The complex functional relationships stated above are derived in Appendix D, Section II, Part 2.

Note that the bending frequency, Eq. (15), is not dependent on the cant angle β. The advantage of the V-stiffening in bending lies in the increase in bending stiffness of the boom and not on the size of the cant angle. This approach is different from that used by GE and is discussed in detail in Appendix D.

b. Lowest Torsion Mode. The frequency of the lowest torsion mode for the rollout solar array is estimated in a similar fashion, thus

$$\omega_T^2 = \frac{T\left[\frac{1}{3} + f_5(\gamma, \ell_B)\ \sin^2\beta\right]}{\ell_B\left[\frac{I_{OB}}{w^2} + \frac{1}{9} M_A + f_6(\gamma, \ell_B, A, B, M_{OB}, M_B)\ \sin^2\beta\right]} \tag{16}$$

where, in consistent units,

I_{OB} = outboard mass moment of inertia about boom axis

w = overall array width

β = cant angle

ω_T = circular torsion frequency, rad/s

All other parameters have been previously defined. The functions f_5 and f_6 are given in Appendix D, Section II, Part 2. Note that the torsional frequency is dependent upon the cant angle.

3. Frequency Equations for Position Boom Scaling

The solar array frequency equations developed in the previous sections assume that the solar array is fixed at the base of the solar array/position boom interface. Since the required system frequency includes the position boom and since such a boom can have an appreciable effect on the system frequency, especially if such a boom is long and slender, scaling laws are required for the design of the positioning boom. Given a positioning boom length ℓ_p and a required system circular frequency $\overline{\omega}_s$, there is no unique solution for the combination of solar array and boom design. The solution is iterative and must be satisfied for any particular design. Since the relationships are complex, weight or volume sensitivity is best established for a particular design under consideration, rather than as a general rule. The equations are derived in detail in Appendix D.

a. Estimation of Position Boom Bending Stiffness Requirement. System frequency in bending, ω_s^B, is related to the position boom bending by the approximate solution

$$\omega_s^B = \left\{ \frac{1}{2}\left[\omega_p^2 + \left(\frac{m_a}{m_p}\right)\omega_a^2\right] - \frac{1}{2}\sqrt{\left[\omega_p^2 + \left(\frac{m_a}{m_p}\right)\omega_a^2\right]^2 - 4\omega_a^2\omega_p^2} \right\}^{1/2} \tag{17}$$

with

$$\omega_p = \sqrt{\frac{3\overline{EI}_p}{\ell_p^3(0.23M_p + 0.5M_A)}} \tag{18}$$

$$\frac{m_a}{m_p} = \frac{M_A}{0.46M_p + M_A} \tag{19}$$

where

M_A = array total mass

M_p = position boom total mass

ℓ_p = position boom length

$\overline{EI}_p$ = position boom bending stiffness

ω_a = array lowest circular frequency assumed to be a bending frequency

Equations (17) through (19) must be solved by trial and error by first selecting $\omega_a > \bar{\omega}_s$, which determines M_A, and using some first cut position boom properties $\overline{EI}_p$ and M_p. The solution must then be iterated upon with a final selection of ω_a and $\overline{EI}_p$ and M_p such that $\omega_s \geq \bar{\omega}_s$.

b. Estimation of Position Boom Torsion Stiffness Requirement. The system frequency in torsion ω_s^T is related to the position boom torsion properties by

$$\omega_s^T = \frac{\omega_T\omega_a}{\sqrt{\omega_T^2 + \omega_a^2}} \tag{20}$$

with

$$\omega_T = \sqrt{\frac{\overline{GJ}_p}{0.7 I_a \ell_p}} \tag{21}$$

where

$\overline{GJ}_p$ = position boom torsion stiffness

I_a = array moment of inertia about position boom axis

and all other variables have been previously defined. Equations (20) and (21) must be solved by trial and error in a similar fashion as it was indicated for sizing the boom bending frequencies. Unless more information is available, ω_a is assumed to be the lowest array frequency under consideration, either bending or torsion. This leads to conservative answers for the boom design. If the array bending and torsion frequencies are available, these should be used in the respective equations, (17) or (20), for a less conservative, more realistic sizing of the position boom. This is explained in more detail in Appendix F.

C. PACKAGING VOLUME EQUATIONS

As discussed in Section VI-C, Packaging Constraints, other than the overall Shuttle Orbiter envelope were considered too numerous to quantify due to the variety of undefined spacecraft configurations. The major packaging volumes can, however, be quantified. These are the solar array stowed volume and the coilable mast canister volume.

The array width as a packaging constraint has been discussed earlier. The height of the stowed (stacked) foldout array and the diameter of the stowed (rolled up) GE array will not vary significantly from the baseline configurations of Refs. 1 through 4 due to the thin blankets designs. The other packaging volume considerations are the coilable mast canister length and diameter. Expressions for these volume requirements have been derived by AEC-Able Engineering Company and are contained in Appendix D, Section I.

This appendix also contains plots for all the equations which are summarized here. The equations defining the required volume will be summarized here for both concepts.

1. Packaging Volume for the LMSC Foldout Boom Canister

a. Canister Height. The canister height H_c, in meters, is defined as

$$H_c = 0.022L + 3.3R \tag{22}$$

where L and R are boom length and boom radius, in meters, respectively. Equation (22) can be expressed as a function of the required boom stiffness $\overline{EI}$ by means of Eq. (2).

b. Canister Diameter. The canister diameter D_c, in meters, is given by

$$D_c = 2.36R \tag{23}$$

Hence, again, D_c can be related to $\overline{EI}$ by Eq. (2). It should be noted that Eq. (23) does not account for protrusions due to motors and related hardware.

2. Packaging Volume for the GE Rollout Boom Canister

a. Canister Height. The canister height H_c, in meters, is given by

$$H_c = 3.05 \times 10^{-6} \frac{L}{\bar{R}^2} \sqrt{\overline{EI}} + \frac{\bar{R}}{\sqrt{2\left(8261.6 \frac{\bar{R}^2}{\sqrt{\overline{EI}}} - 1\right)}} + 1.5\bar{R} \tag{24}$$

where the variables are defined as in Eqs. (5) and (6).

b. Canister Diameter. The canister diameter D_c is given by

$$D_c = 2.36\bar{R} \tag{25}$$

where $\bar{R}$ is the boom radius for minimum system mass.

IX. DESCRIPTION OF COMPUTER PROGRAMS

The parametric equations developed in the previous chapter can be programmed on the digital computer to produce data for the two types of solar array designs. A multitude of data can be generated for the various dependent and independent variables, such as power, width, weight, and frequency.

Two types of plots considered most meaningful have been developed: (1) specific power, kW/kg, versus frequency in Hz for constant width, in meters, and (2) specific power, kW/kg, versus width, in meters, for constant frequency, Hz.

A detailed description of the computer programs used to generate data and to develop the plots is not included in this report. Only the mechanics of the computer programs will be described here as they relate to the development of the data.

A. COMPUTER PROGRAM FOR FOLDOUT SOLAR ARRAY DESIGN DATA

1. Data Flow

The process for developing foldout solar array design data is as follows. For a desired power level per wing the required array area can be determined from the blanket power density. This determines the blanket mass. Next the array widths of interest and the frequency range are specified. All the component weights of the array can be calculated directly for any given width and frequency, except the boom weight.

The required boom stiffness, $\overline{EI}$, is obtained from the solution of a quadratic equation resulting from Eqs. (1) and (13). The boom weight can then be determined by Eq. (1). The total wing weight is thus determined. Next the torsional frequency is calculated using Eq. (14), using the boom torsional stiffness, which is related to the boom bending stiffness (see Appendix D, Section I).

The derivation of the lowest bending mode must be developed to account for root flexibility at the boom/canister interface. An approximate correction to account for root flexibility is made in the following manner, assuming that the boom root spring acts in series with the boom bending stiffness and that the effect of the root spring does not appreciably change the boom deflected shape in the first bending mode. The frequency f_R, in Hz, of a rigid solar array connected to the base by a root spring is estimated as

$$f_R = \frac{1}{2\pi}\sqrt{\frac{K_R}{I_T}} \tag{26}$$

where

K_R = boom root spring

I_T = array moment of inertia about the attachment point

If the bending frequency of the solar array without the effect of the root spring is f_B in Hz, then the bending frequency accounting for the root spring, f_B' in Hz, can be estimated by

$$f_B' = \frac{f_B f_R}{\sqrt{f_B^2 + f_R^2}} \tag{27}$$

Typically the difference between f_B' and f_B for this study was less than 10%.

A minimum solar array frequency is now chosen from the torsional frequency as calculated from Eq. (14) and the augmented frequency of Eq. (27). This minimum frequency is plotted vs the specific power. Various checks are performed by the program, such as (1) the tension is not allowed to be less than 2.2 newtons (0.5 lb) for each tensioner; (2) the adequacy of the boom is checked for bending strength and longeron buckling capability.

2. Input Constants

The following input constants can be used for the LMSC foldout solar array:

Blanket power density	0.0989 kW/m^2
Blanket mass density	0.895 kg/m^2
Weight contingency factors	Varying between 1.05 for the blanket to 1.15 for other components as specified by LMSC (see Appendix A)

3. Output Data

The program can determine numerous design variables, which are beyond the scope of this parametric study but which are included for a selected group of configurations in Appendix E.

The following output can be calculated and printed:

(1) Detailed weight list of all elements

(2) Outboard center of gravity location of array

(3) Moments of inertia of array

(4) Boom design values, such as:

(a) Boom bending stiffness

(b) Boom diameter

(c) Boom root stiffness

(d) Boom canister height and diameter

(e) Boom strength margin

(f) Boom buckling margin

(5) Total array weight and mass

(6) Minimum array frequency

(7) Specific power of array

(8) Array width, length, and aspect ratio

B. COMPUTER PROGRAM FOR ROLLOUT SOLAR ARRAY DESIGN DATA

1. Data Flow

The process for developing rollout solar array design data is similar to that used for the foldout. Emphasis was placed on the differences. The blanket area can be determined from the power and the power density. Next the array widths of interest are specified. Allowance for the boom location was made by using a 33-cm clearance between the boom and the blanket edge.

Next a range of tensions is specified. Due to the form of the frequency equation (15), it is impractical to specify a range of frequencies.

Before the calculations can proceed, the parameter γ, to be used in Eq. (15), must be determined. Ideally, a γ should be selected to maximize frequency or specific power output. By analogy to the LMSC approach for the foldout configuration, γ should be maximized to minimize $\overline{EI}$ and, hence, boom weight. Such a maximization could not be implemented in closed form due to the complexity of the algebraic expressions (see Appendix D, Section II).

An optimization of γ by incremental evaluation for each configuration was considered beyond the scope of this parametric study. First, it is noted that the frequency equations are functions of the dimensionless parameter $\overline{\gamma}$ and not of γ, where

$$\overline{\gamma} = \ell_B \sqrt{\frac{T}{\overline{EI}}} \tag{28}$$

Introducing

$$P_{cr} = \frac{\pi^2 \overline{EI}}{\ell_B^2} \tag{29}$$

and

$$\eta = \frac{T}{P_{cr}} \tag{30}$$

where P_{cr} is the critical Euler column buckling load, then $\overline{\gamma}$ can be expressed as

$$\overline{\gamma} = \sqrt{\eta}\ \pi \tag{31}$$

Now, for the GE rollout 10 kW/wing and 60 kW/wing, η equals 0.80 and 0.61, respectively. Thus, $\overline{\gamma}$ varies from 2.81 for the 10-kW/wing array to 2.45 for the 60-kW/wing array. For purposes of this parameter study, the following values were chosen:

$\eta = 0.7$

$\overline{\gamma} = 2.63$

It should be observed that the V-stiffening has the effect of tripling the critical buckling load as determined from Eq. (29). This is due to the end constraints on the boom; thus, the effective values of η are reduced to 0.27 for the 10-kW/wing array and 0.20 for the 60-kW/wing array. The effects of V-stiffening on the buckling strength of the extensible mast is discussed in detail in Ref. 6.

The selection of one value for η for this parametric study is justified since an extrapolation from existing designs was to be performed, and it is consistent with the approach used in obtaining the extrapolation for the weight scaling equations of Appendix D.

Having set the value of $\overline{\gamma}$, Eqs. (15) and (16) can be solved for the bending and torsion frequencies, respectively. It should be noted that Eq. (15) leads to two real positive roots; the smaller root is used for the frequency calculation, since it corresponds to a mode shape wherein the blanket and the mast are in phase. The larger positive root corresponds to a mode shape, wherein the blanket and mast move out of phase. For plotting, a minimum array frequency is chosen from the bending frequency and the torsion frequency. Checks for boom strength and longeron buckling are performed by the program.

2. Input Constants

The following input constants can be used for the GE rollout array:

Blanket power density	0.139 kg/m^2
Blanket mass density	0.368 kg/m^2
Weight contingency factors	1.05 for blanket weight, 1.15 for all other components
Gravity	10^{-3} g

3. Output Data

The output data for the rollout solar array is the same as that supplied for the foldout. In addition, the clearance between the boom and the blanket can be obtained.

X. PARAMETRIC DATA PLOTS

This section contains the parameter data plots developed from the computer programs. The plots exhibiting (a) specific power, kW/kg, versus solar array frequency, Hz for constant solar array width in meters, and (b) specific power versus solar array width in meters for constant solar array frequency are included at the end of this report. The input parameters have been described in Section IX and in Table 3.

There is one plot for each power level ranging from 10 kW to 80 kW/wing in increments of 5 kW.

The data plots cover a frequency range from 0.005 to 0.05 Hz and aspect ratios from 4 to 10. The lower frequency bound of the plots, if higher than 0.005 Hz, is determined by the minimum tension requirement imposed by the mechanisms. The strength capability ratio was not used in determining the lower bound of the plots, but is supplied in the detailed printout for selected configuration in Appendix E. For designs requiring array frequencies below 0.01 Hz, it is advisable to check the strength capability ratio. The equations for the boom strength capabilities are given in Appendix D.

A. FOLDOUT SOLAR ARRAY

For the foldout solar array, the specific power, kW/kg, versus array frequency is plotted in Figs. 6(a) through 6(o) for constant array width. For the lower power levels per wing, such as 10 kW/wing, some of these curves cross due to the additional weight penalty for the broken array configurations.

The specific power, kW/kg, versus width in meters is plotted in Figs. 7(a) through 7(o). Note the discontinuities of some of these curves for the smaller power levels per wing. This is due to the transition from an unbroken to broken configuration at 4 meters total width.

B. ROLLOUT SOLAR ARRAY

For the rollout solar array, the specific power, kW/kg, versus array frequency is plotted in Figs. 8(a) through 8(o) for constant array width. The peculiar change in slope of some of these curves is due to the weight sensitivity of the shaft to the design conditions. At higher frequencies the shaft is designed for a deflection limitation due to blanket tension; at lower frequencies the launch loads govern the shaft design. The latter allows a lower weight shaft.

The unevenness of the curves comes from the negator spring weight, which is determined from design tables supplied by the manufacturer. The negator spring weights depend on the torque requirement and changes in a step function-like fashion.

The specific power, kW/kg, versus width in meters is plotted in Figs. 9(a) through 9(o). Note the change in slope at 4 meters for the 10-kW/wing plot. This is due to the transition from an unbroken to a broken configuration at 4 meters total width.

XI. TECHNICAL EVALUATION OF THE CONCEPTUAL DESIGNS

A technical evaluation of the conceptual designs was made only to the depth to which design details for the two solar array configurations are available. Such an evaluation was consistent with the accuracy and scope of the parametric study. The technical evaluation and the discussion of the relative merits have been divided into three major areas: thermal, structural, and mechanical.

A. THERMAL CONSIDERATIONS

1. Extendable Booms

The coilable mast of the foldout solar array is inherently more spatially uniform in temperature than the mast of the rollout solar array. This is because the former "sees" a nearly uniform thermal environment (space and the rear side of the cell blanket), whereas the latter is exposed to direct solar irradiation and its temperature distribution is highly sensitive to geometry and spatial variations in thermo-optical surface properties. However, with the addition of the astromast thermal sleeve, the rollout astromast can be made more thermally equivalent to the foldout design.

2. Blanket

For in-bound missions at a distance less than 0.7 AU, both solar arrays must be rotated off-normal to the sun in order to avoid overheating beyond design temperature limits (and, with silicon solar cell technology, to get reasonable solar-to-electrical conversion efficiency). Tilting the solar array does not seem to be a viable option. For rotated solar arrays the flat single blanket foldout design would tend to be uniform in temperature. However, on the rollout V-stiffened design, each half blanket would operate at a different temperature. The temperature differences grow with decreasing heliocentric distance. This phenomenon occurs because each half blanket of the GE design receives a different effective solar irradiance.

3. Summary of Thermal Considerations

Both solar arrays use essentially the same type of solar cells, filters, adhesive, coverslides, AR coatings, and substrates and should be thermally equivalent. This is true if the solar cells are in intimate thermal contact with the substrate.

This requirement has been met in the rollout solar array blanket design. In the foldout blanket design, the solar cells are conductively coupled to the substrate at four contact welds to the interconnects of the substrate. This leaves a large area of the solar cell surface to radiate its heat to the substrate. These thermal paths will result in higher solar cell temperatures and correspondingly lower conversion efficiency.

Assuming thermal equivalent blanket designs, the relative merits of both solar array configurations are mission dependent with the foldout having the advantage for in-bound missions of less than 0.7 AU.

The single blanket design of the foldout solar arrays provides the advantage for uniform temperature distribution for the deployable mast.

B. STRUCTURAL CONSIDERATIONS

1. Blanket Construction

Disregarding solar cell weight, the foldout solar blanket is heavier due to the use of support frames. The preliminary investigations into flatness, excluding the dynamic effects, indicate no advantage in this heavier construction, even when thermal effects are included. Both concepts are structurally highly nonlinear, having different sources for this behavior. The nonlinear aspects for the rollout are probably better understood at this point than the foldout. Which nonlinearity is more cumbersome from a control analysis point of view cannot be answered at this time.

2. Extension Boom

The extension boom/canister system weight is higher for the foldout solar array due to: (a) design philosophy, the boom for the foldout is designed for a constant strain with some volume constraints rather than for minimum system weight as is done for the rollout; and (b) the eccentric loading imposed by the blanket tension.

The design philosophy can be changed but the eccentric load is inherent in the concept and, hence, will result in a heavier boom for the foldout configuration even when compared to a flat rollout concept.

3. Tip Mass

The tip mass for the foldout solar array will always be heavier because the containment box cover is designed for launch loading and not for the cruise configuration. The tip mass has a direct impact on the solar array frequency. The rollout array tip weight consisting of header and leading edge weight is lighter since the latter design is controlled only by the cruise requirements.

4. V-Stiffness Array

The rollout concept with the V-stiffened concept is structurally very attractive. There is no question that the V-stiffened concept saves extension boom weight.

5. Folding Structure

Both solar arrays, when the width exceeds 4 meters, will require a folding blanket structure for attaching to the spacecraft for launch. The folding structure will complicate either design structurally. There is no evidence that one solar array concept is better than the other when folding is required.

6. Solar Cell Storage

The foldout concept has a better support method for the solar cells during launch. The rollout array drum design is potentially more complex since the solar cells have an initial curvature due to the drum radius. An additional, double curvature, may be induced due to drum bending moments during launch. A prototype rollout drum assembly has successfully passed vibration testing, as reported in Ref. 6. The drum design would depend on cell thickness.

7. Lowest Torsion Mode

The foldout array takes advantage of the boom stiffness in torsion while the rollout does not, since it has a torsion bearing at the header. The torsional frequency of the rollout could be raised by locking the header to the end of the boom after deployment.

8. Coupling of Bending and Torsion Modes

The V-stiffened design inherently produces mast bending in the torsion mode, thus coupling torsion and inplane boom bending. This results in more complex dynamic motion of the arrays and, ultimately, the spacecraft system. The impact on the design of the control system, if any, is not known at this time. The foldout has less complex dynamic motion.

9. Boom Design Margins

The boom design margins for the rollout solar array are higher than for the foldout. The basic reason for this is that the V-stiffening increases the allowable load due to buckling while the eccentric loading for the foldout decreases it. The values for P/P_{cr} for the GE rollout solar array 10 kW/wing and 60 kW/wing are 0.27 and 0.20, respectively when the effect of V-stiffening is accounted for. The corresponding values for the LMSC foldout solar array 12 kW/wing, 30 kW/wing, and 60 kW/wing are 0.29, 0.50, and 0.33, respectively, when the eccentric load is accounted for.

10. Summary of Structural Considerations

Structurally the rollout design is more weight efficient. Both designs offer challenges in the analysis modeling area.

C. MECHANICAL CONSIDERATIONS

1. Slip Ring Assembly

The rollout solar array uses slip rings which are not required for the foldout. This results in a weight advantage for the foldout solar array.

2. Tensioning Mechanisms

In the rollout concept, all of the tensioning mechanisms are contained in the drum. There is no need to run wires along the solar array. This is a simpler mechanical design than the foldout. Weight-wise, however, the tensioners for the rollout get voluminous and can be heavier than those used for the foldout. As far as tensioning mechanisms, the rollout is simpler and more reliable, but may be heavier.

3. Mast Thermal Sleeve

The thermal sleeve proposed for the rollout solar array mast is mechanically cumbersome. For a one-time deployment, the mechanization is not difficult, although it adds complexity. It is very difficult, however, to make a sleeve which will retract reliably.

4. Cover Launch Latch

The rollout solar array has the advantage of not requiring a launch latch, thus saving weight.

5. V-Stiffening

The V-stiffness design does have a disadvantage that there are forces which act to wrinkle the blanket. For static loading this wrinkling effect was shown to be negligible. The wrinkles resulting from dynamic excitation have not been investigated.

6. Summary of Mechanisms Considerations

Mechanically, the rollout array is a simpler, more reliable design, although not necessarily lighter. The proposed thermal sleeve is an undesirable complication.

D. SUMMARY OF EVALUATIONS

Based on the information gathered from the thermal, structural, and mechanism evaluations, the following summary statements can be made in regard to the key merits and limitations of the foldout and rollout flexible solar array design:

(1) The rollout design has a weight advantage over the foldout design primarily because of the V-stiffening configuration, and of the blanket construction.

(2) For in-bound missions, both solar array designs must be rotated "off normal" to the sun in order to limit the blanket temperature within the upper design limit. The blanket design is, therefore, critical to ensure good thermal radiation to space. (See note in the Summary of Thermal Considerations.) The rollout design, because of the V-stiffening configuration, requires a more complex temperature control strategy.

(3) The rollout solar array uses a split blanket design to satisfy the V-stiffening approach. This exposes the solar array mast to direct solar irradiation and creates undesirable temperature gradients on the longerons of the mast.

The temperature gradients are highly dependent on the geometry and spatial variations of the thermal-optical surface properties. A sleeve cover over the mast has been proposed to alleviate the temperature gradient problem.

(4) The rollout solar array requires slip rings to transfer power from the solar arrays to the spacecraft. Based on the present state of the art, slip rings of high power capacity have not been qualified.

(5) Mechanically, the rollout solar array is simpler, uses less parts, and, therefore, is more reliable than the foldout design.

(6) In general, the rollout solar array design has some mechanical or performance advantages over the foldout design for outbound mission applications while the foldout solar array design has some mechanical or performance advantages over the rollout design for inbound mission applications, provided that the blanket design is thermally equivalent for both solar array designs.

XII. CONCLUSIONS

A parametric study to evaluate the effects of mechanical design parameters on the performance of the flexible low-mass, high-power, foldout and rollout solar arrays has been conducted, and data plots and computer programs have been generated which can be used as a design monograph for future designs.

The data plots display (a) specific power in kW/kg versus solar array frequency for constant solar array width, and (b) specific power versus solar array width for constant solar array frequency. The data plots developed are for the foldout and rollout solar array designs being developed by Lockheed Missiles and Space Company for Marshall Space Flight Center and by General Electric Space Systems for the Jet Propulsion Laboratory. The data plots cover a power range of 10 kW to 80 kW/wing.

Detailed derivations of the equations are included in the appendixes of this report.

The parametric study required an in-depth study of the developed and conceptualized foldout and rollout solar array design data, and the development of additional data and design modifications to strengthen the credibility of both designs. In the course of the study, a number of design equations had to be developed and computer programs were generated.

This background provided a wealth of information on both solar array designs which prompted the technical evaluation and discussion of their relative merits. The evaluation was consistent with the accuracy and scope of the parametric study and was made only to the depth to which design details for the two solar array configurations were available.

The parametric study conducted was a limited view and evaluation of both solar array designs as candidate power sources for future high-power, low-mass missions. In the course of this study many assumptions had to be made. It is important to realize that the data plots and computer programs generated were based on limited information. Further analysis is necessary to evaluate and to understand the performance and the behavior of these solar arrays in the space environment. In addition to the analysis, some testing of small scale models is recommended for the verification of the analyses performed.

XIII. IDENTIFICATION OF AREAS FOR FUTURE TECHNOLOGY

This study was limited to an evaluation of two array concepts at a heliocentric distance of 1 AU. Wherever possible, the equations have been developed and some data have been generated for distances other than 1 AU.

In the course of this investigation many assumptions had to be made. This section summarizes future technology in two basic categories: (1) areas of analysis and/or test to substantiate the assumptions, and (2) areas of the technology which were beyond the scope of this effort but which require additional investigations.

A. AREAS OF TECHNOLOGY FOR VERIFICATION OF ASSUMPTIONS MADE FOR CALCULATION OF BLANKET FLATNESS

The derivations of the flatness criteria are based on the assumption of an ideal thin film. The behavior of the actual blanket when subjected to the various disturbances and misalignments discussed in Appendix B should be investigated. This could best be accomplished using small scale testing and coupon tests.

The effects of non-flatness due to manufacturing should also be investigated.

In the course of the investigations into the flatness criteria, it was shown mathematically that it is advantageous to tailor the array blanket such that its width at the center, perpendicular to the tension, is somewhat less than at the fixed edges where the tension is applied. Such a design introduces stresses perpendicular to the direction of tension and has the effect of counteracting the formation of wrinkles along the length of the blanket. The amount of such a reduction in width and its effectiveness should be studied further.

B. AREAS OF ANALYSIS FOR FUTURE SOLAR ARRAY TECHNOLOGY

The following areas of investigation are identified as potential candidates for advancing the solar array technology:

(1) Dynamic effects on flatness criteria. The effect of the dynamic excitations produced by the control system on the solar array power loss should be investigated. This effect is control system and trajectory dependent.

(2) Coupled dynamic and thermal effects on structural integrity. At small heliocentric distances, the thermal effects on the degradation will effect frequency and, hence, potentially the structure/control interaction dynamics as a function of trajectory as well as the strength of the structural elements of the array.

(3) For Earth orbit applications the possibility of thermal flutter should be investigated.

(4) Extension of parametric study to include other existing design concepts such as FRUSA.

(5) Design data for the competing concepts using a common solar cell technology. This study considered the arrays as originally designed only, namely, the foldout array using a nominal 66-W/kg cell technology and the rollout array using a 200-W/kg cell technology. Parametric data for other consistent cell technology for both arrays should be generated such that the specific power can be directly comparable between the two.

(6) Analysis of nonlinear effects. The array system is highly nonlinear. This has been shown to be the case experimentally for the rollout configuration (Ref. 6.) There is no reason to believe that the foldout array does not exhibit similar phenomena, even though no test data is available for this array. The mechanism for the nonlinearities might be different due to the different blanket construction.

The effect of such nonlinearities on the structure/controls interaction should be investigated. A first step would consist of a piecewise linear analysis as compared to a nonlinear analysis to verify the importance of these phenomena. A first step in categorizing the problems of nonlinear phenomena in solar array is contained in Ref. 6.

(7) Testing methods. Since full scale verification of the solar array in earth gravity is impractical, an integrated test and analysis approach will have to be used for the verification of the structural integrity of the array system.

The objective of such an integrated approach would be to maximize the probability of success. Investigations into the integrated test/analysis verification program should include feasibility studies for dynamic testing, using a reduced scale model, selected tests of components, and possibly flight experimented.

(8) Moment compensating device. A moment compensating device for the foldout configurations should be considered. A saving in the boom weight can be realized by eliminating the eccentricity on the extension mast. The compensating device does, however, add complexity and reduces reliability. The moment compensating device was considered to be beyond the scope of this study.

(9) Criteria for structure and control interaction. This study was confined to the use of frequency as a parameter because guidance and control requirements traditionally have imposed frequency as a structural design criteria. Frequency in itself is not necessarily a meaningful criteria. A more meaningful criteria, for example, might be the effective mass for a particular normal mode at a given frequency. The concept of effective mass has been successfully used in load analyses in the past.

An investigation as to a more meaningful criteria for solar array control problems might be beneficial and might lead to weight savings if the frequency requirement can be relaxed.

REFERENCES

1. Solar Array Technology Development for SEP, Mid-Term Report, Lockheed Missiles and Space Company Report LMSC-D492693, 18 January 1977.

2. Extended Performance SEP Solar Array Study, Final Report, Lockheed Missiles and Space Company, Report LMSC-D573740, 19 July 1977.

3. Conceptual Approach Study of 200 Watt Per Kilogram Solar Array, Final Report, General Electric Space Division Report 77 SDS 4207, 31 August 1977.

4. Solar Array Conceptual Design for the Halley's Comet Ion Drive Mission, Final Report, General Electric Space Division Report SDS 4243, 31 August 1977.

5. Design and Analysis, Space Station Solar Array Technology Evaluation Program, Second Topical Report, Lockheed Missiles and Space Company Report LMSC-A995719, November 1971.

6. Rollup Subsolar Array, Final Report, General Electric Space Systems Organization Report GE-SSO-7050 4286, February 1, 1971.

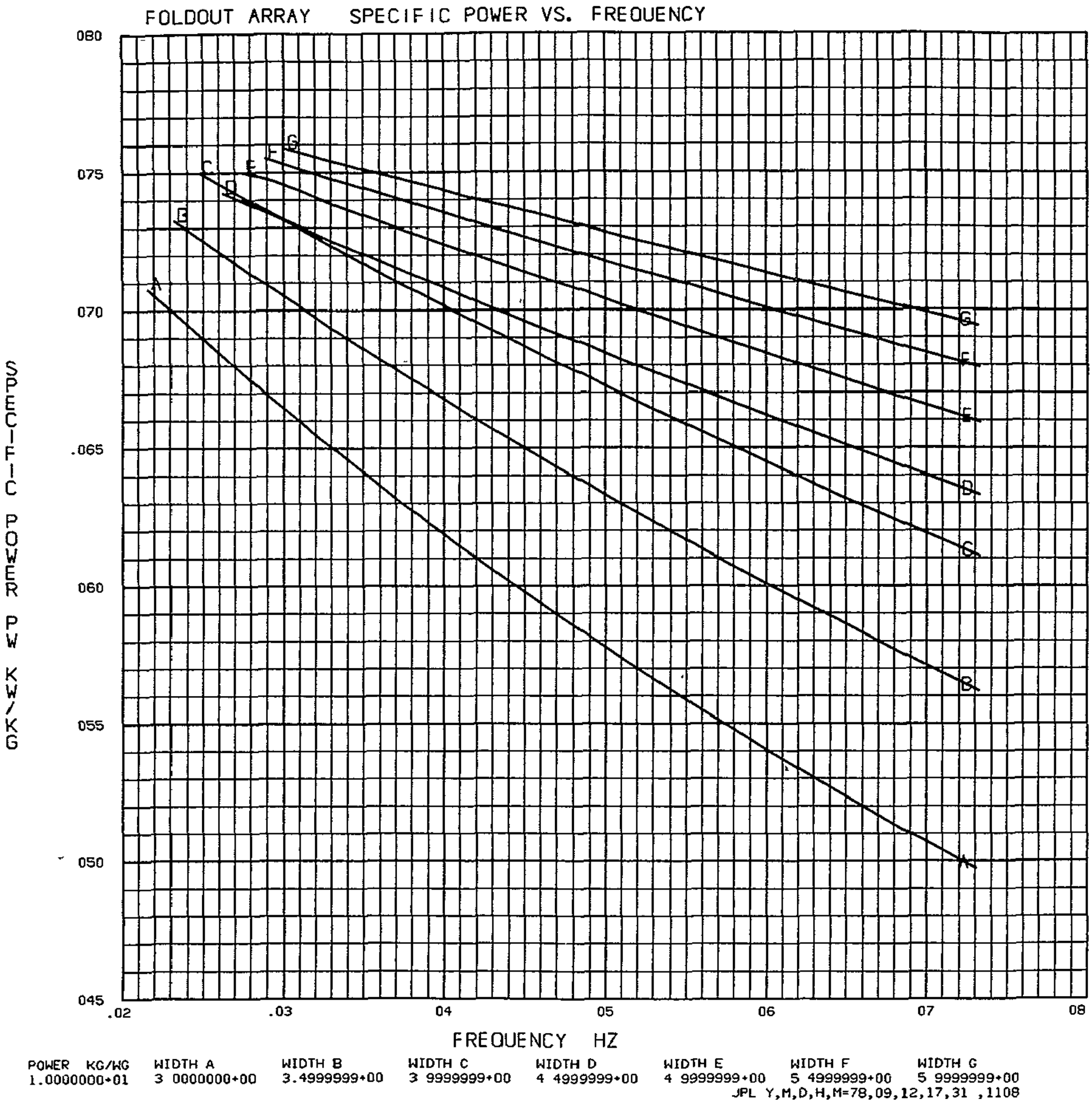


Figure 6(a). Foldout Array Specific Power vs Frequency, 10 kW/wing

ORIGINAL PAGE IS
OF POOR QUALITY

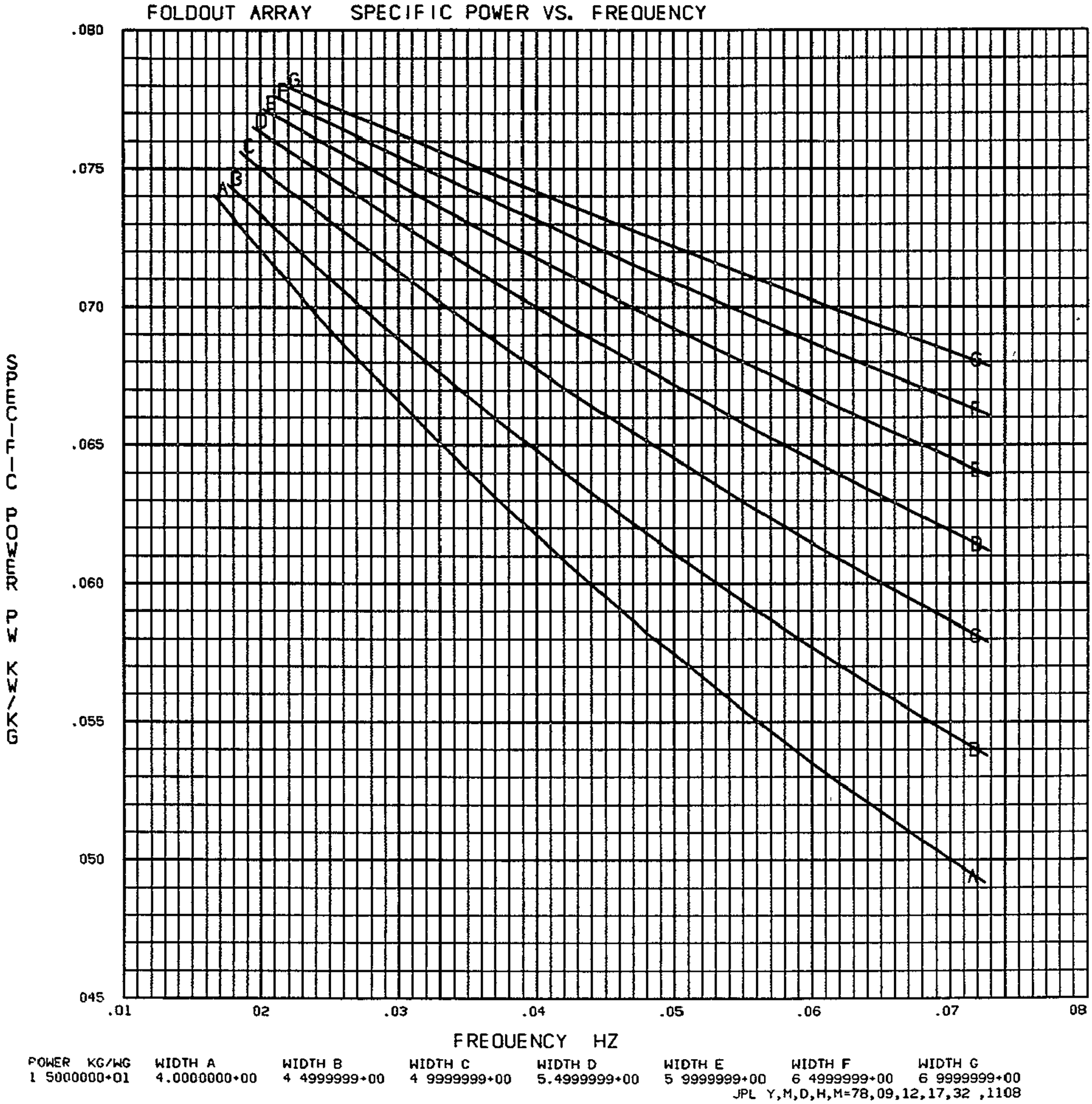


Figure 6(b). Foldout Array Specific Power vs Frequency, 15 kW/wing

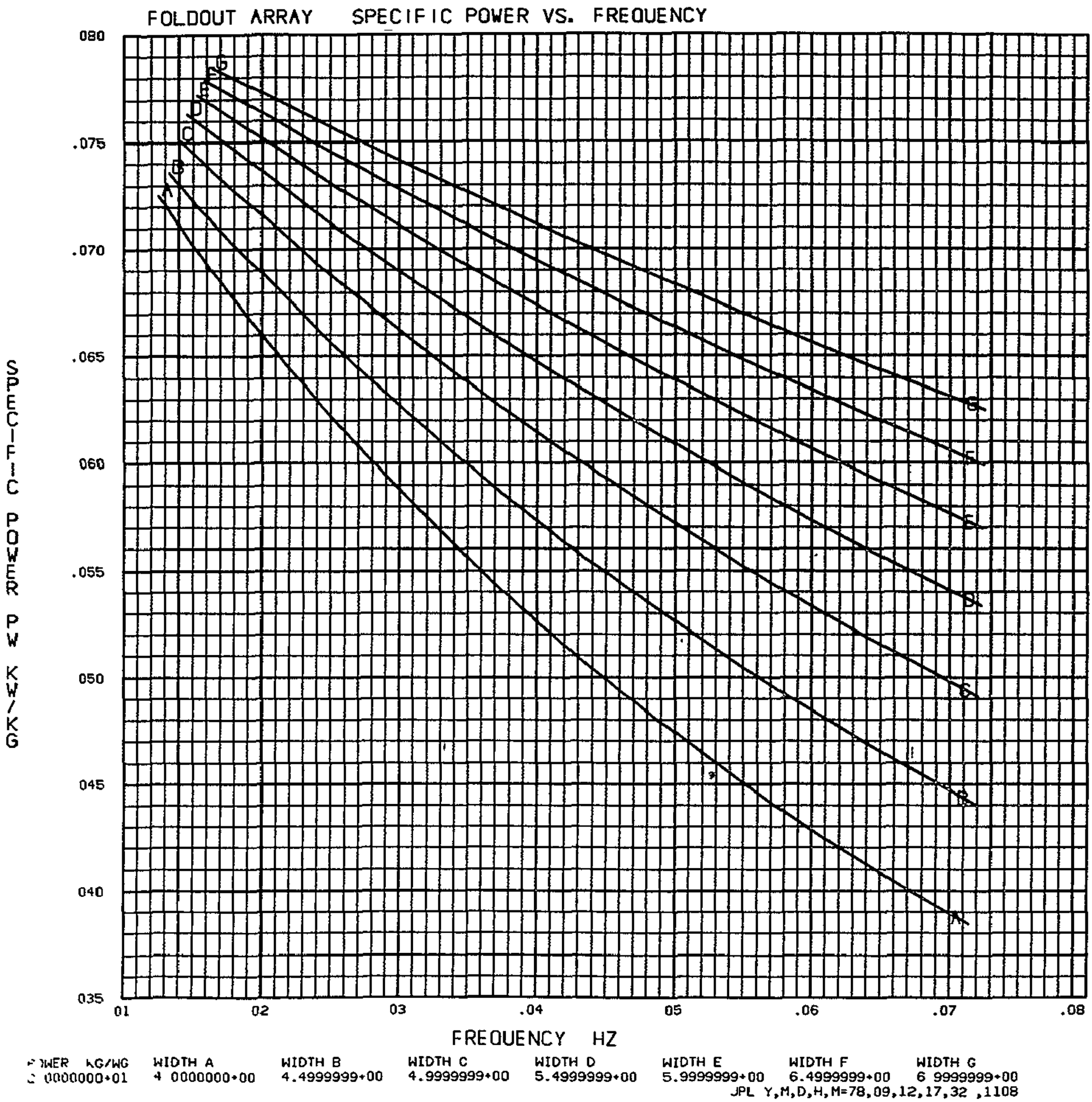


Figure 6(c). Foldout Array Specific Power vs Frequency, 20 kW/wing

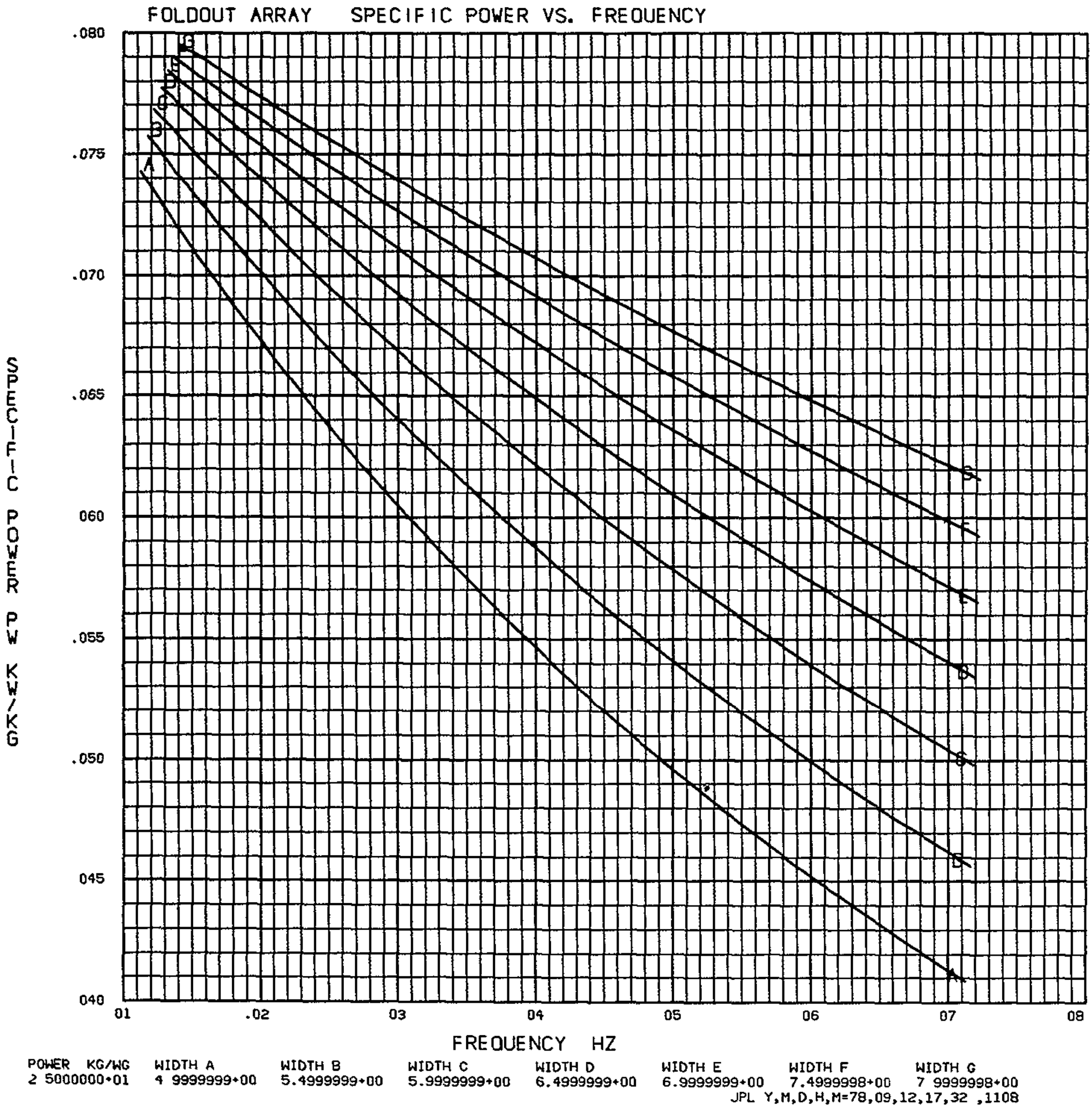


Figure 6(d). Foldout Array Specific Power vs Frequency, 25 kW/wing

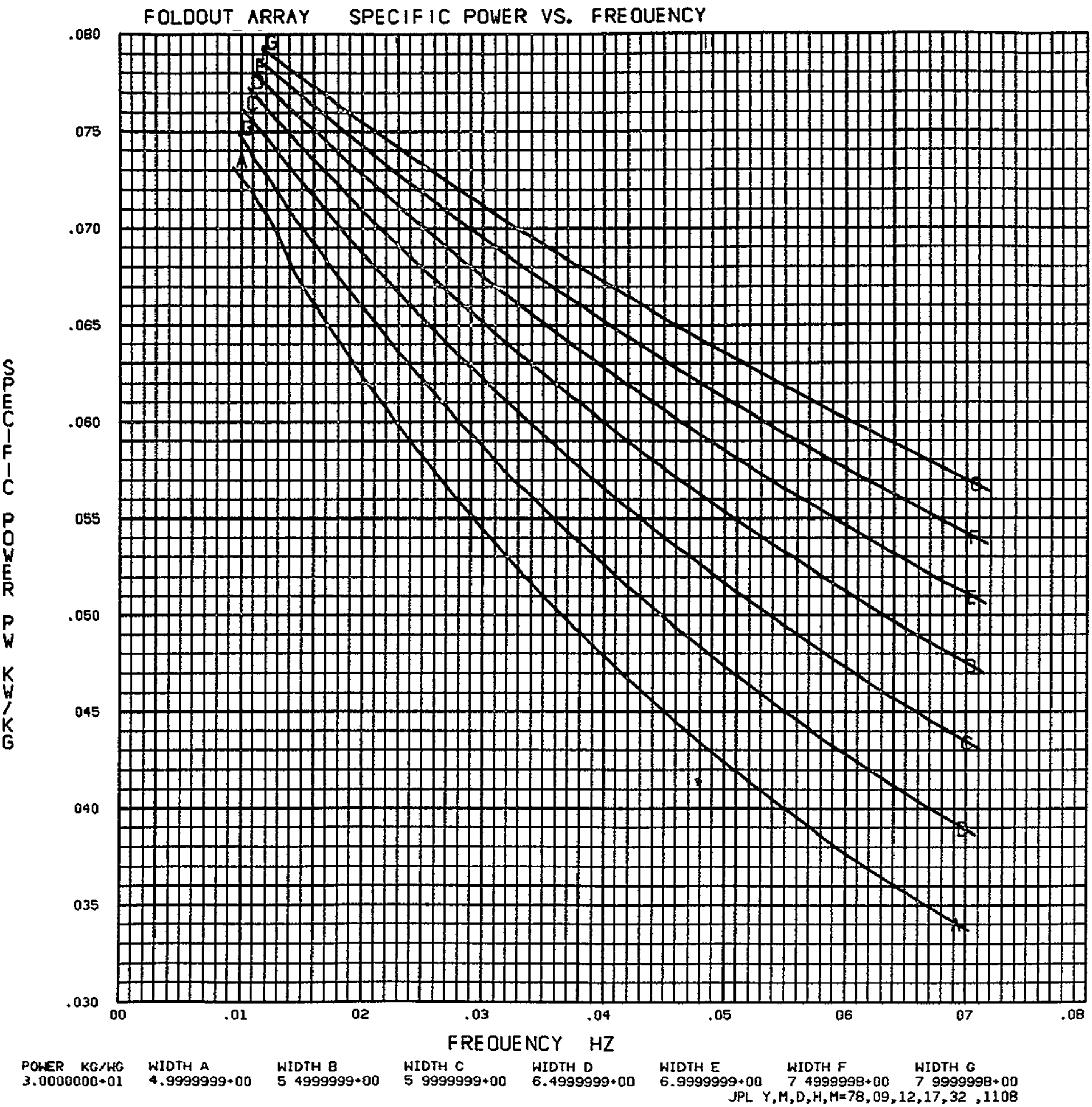


Figure 6(e). Foldout Array Specific Power vs Frequency, 30 kW/wing

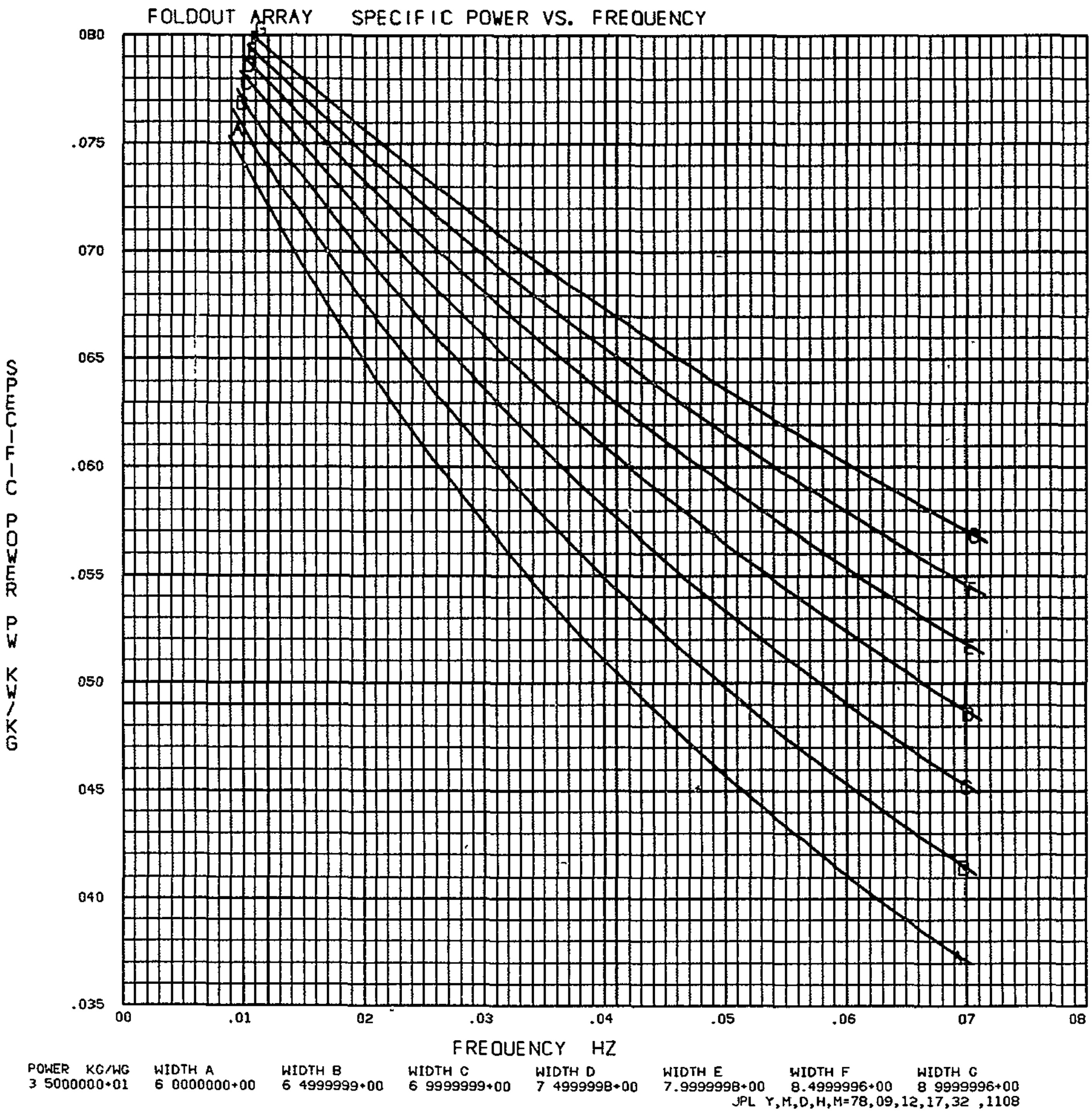


Figure 6(f). Foldout Array Specific Power vs Frequency, 35 kW/wing

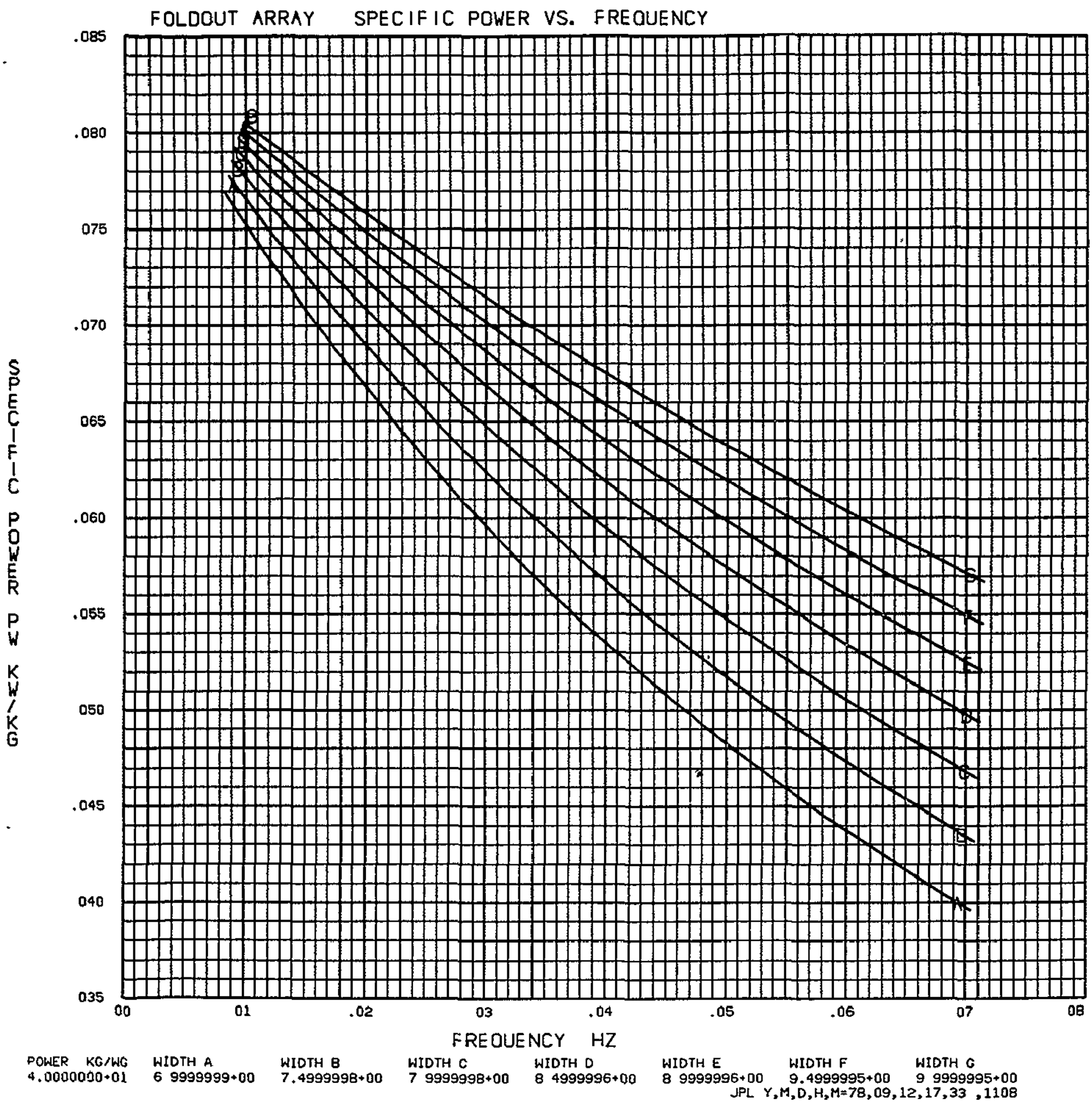


Figure 6(g). Foldout Array Specific Power vs Frequency, 40 kW/wing

ORIGINAL PAGE IS
OF POOR QUALITY

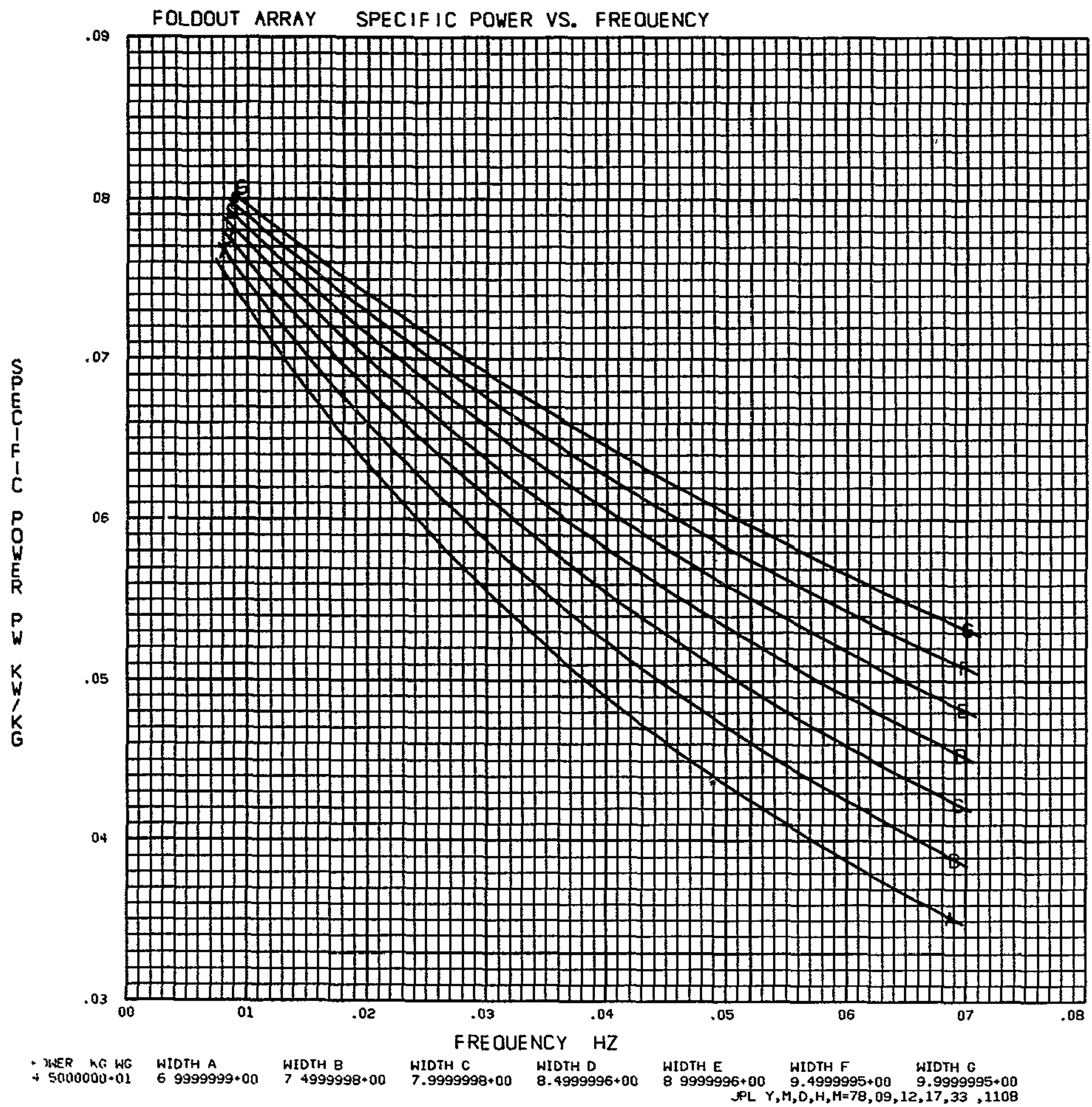


Figure 6(h). Foldout Array Specific Power vs Frequency, 45 kW/wing

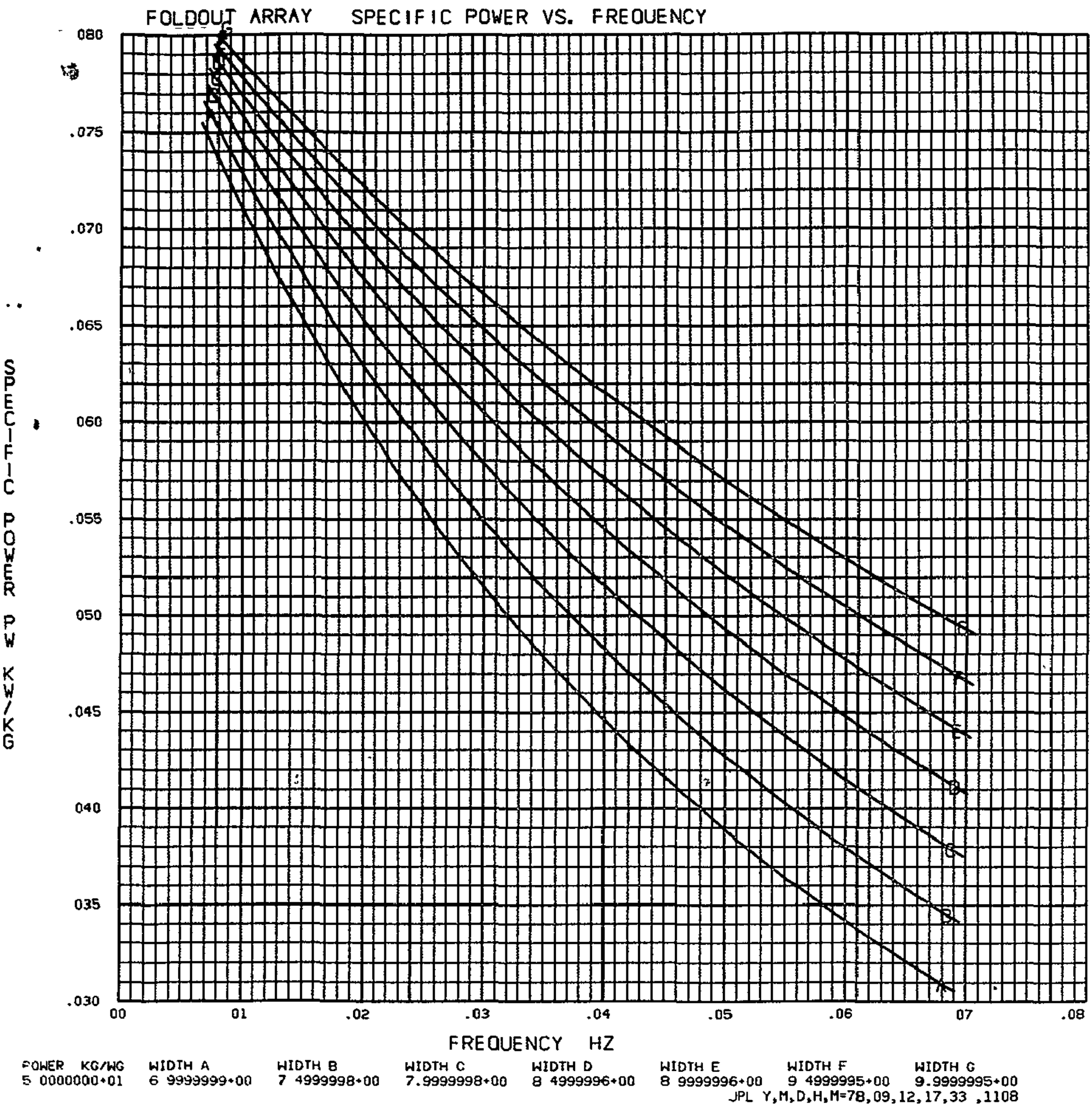


Figure 6(i). Foldout Array Specific Power vs Frequency, 50 kW/wing

ORIGINAL PAGE IS
OF POOR QUALITY

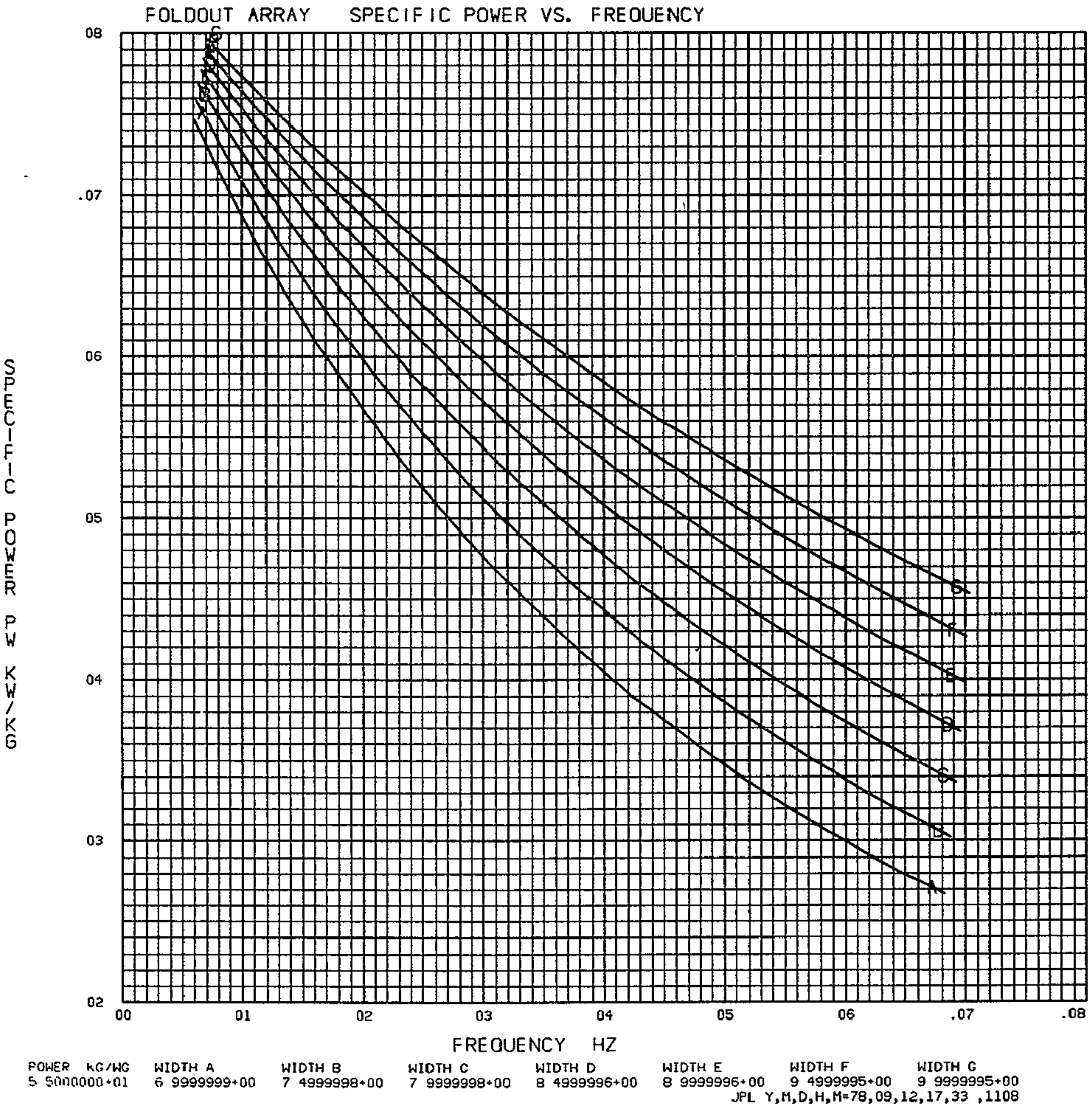


Figure 6(j). Foldout Array Specific Power vs Frequency, 55 kW/wing

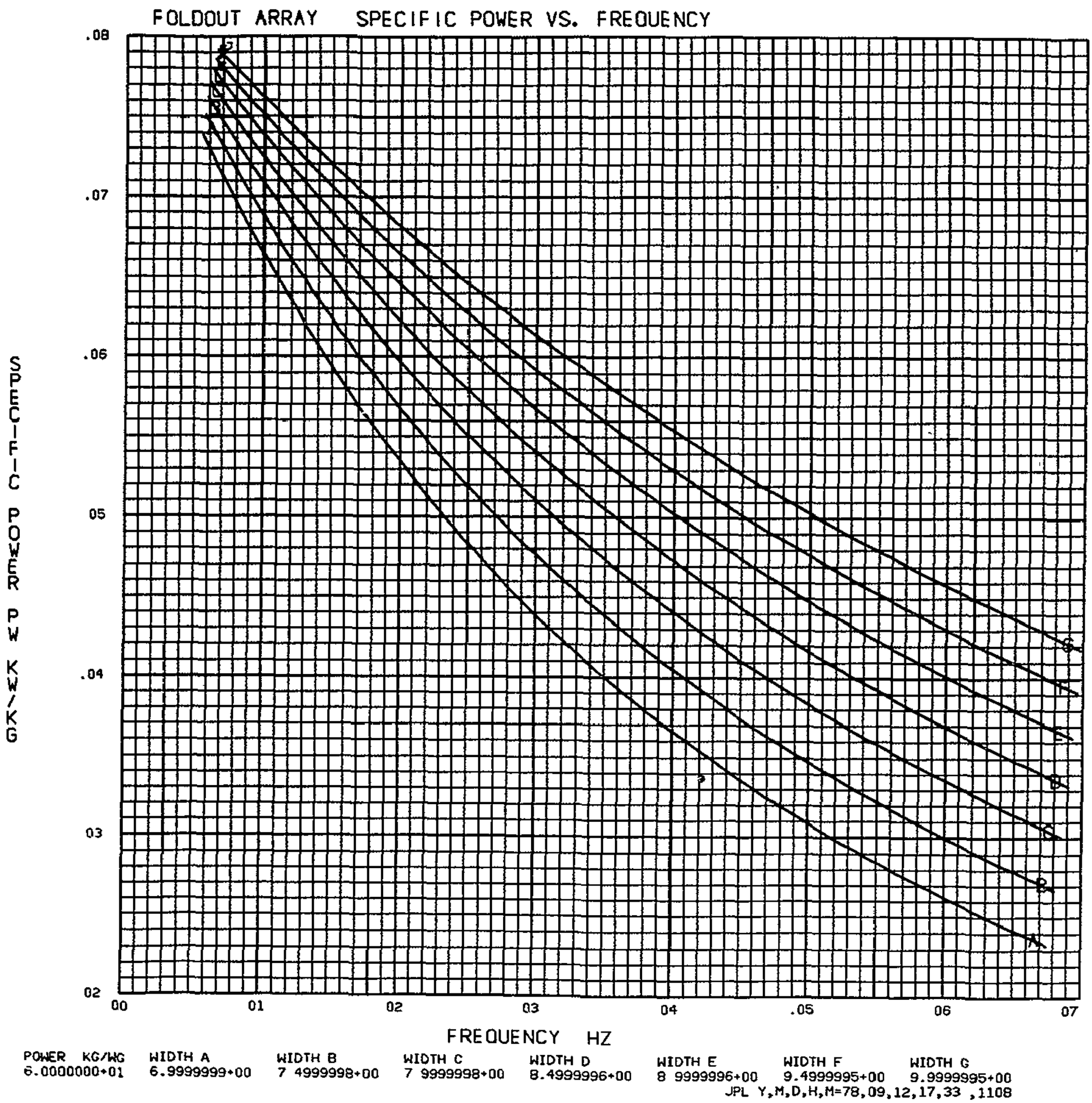


Figure 6(k). Foldout Array Specific Power vs Frequency, 60 kW/wing

ORIGINAL PAGE IS
OF POOR QUALITY

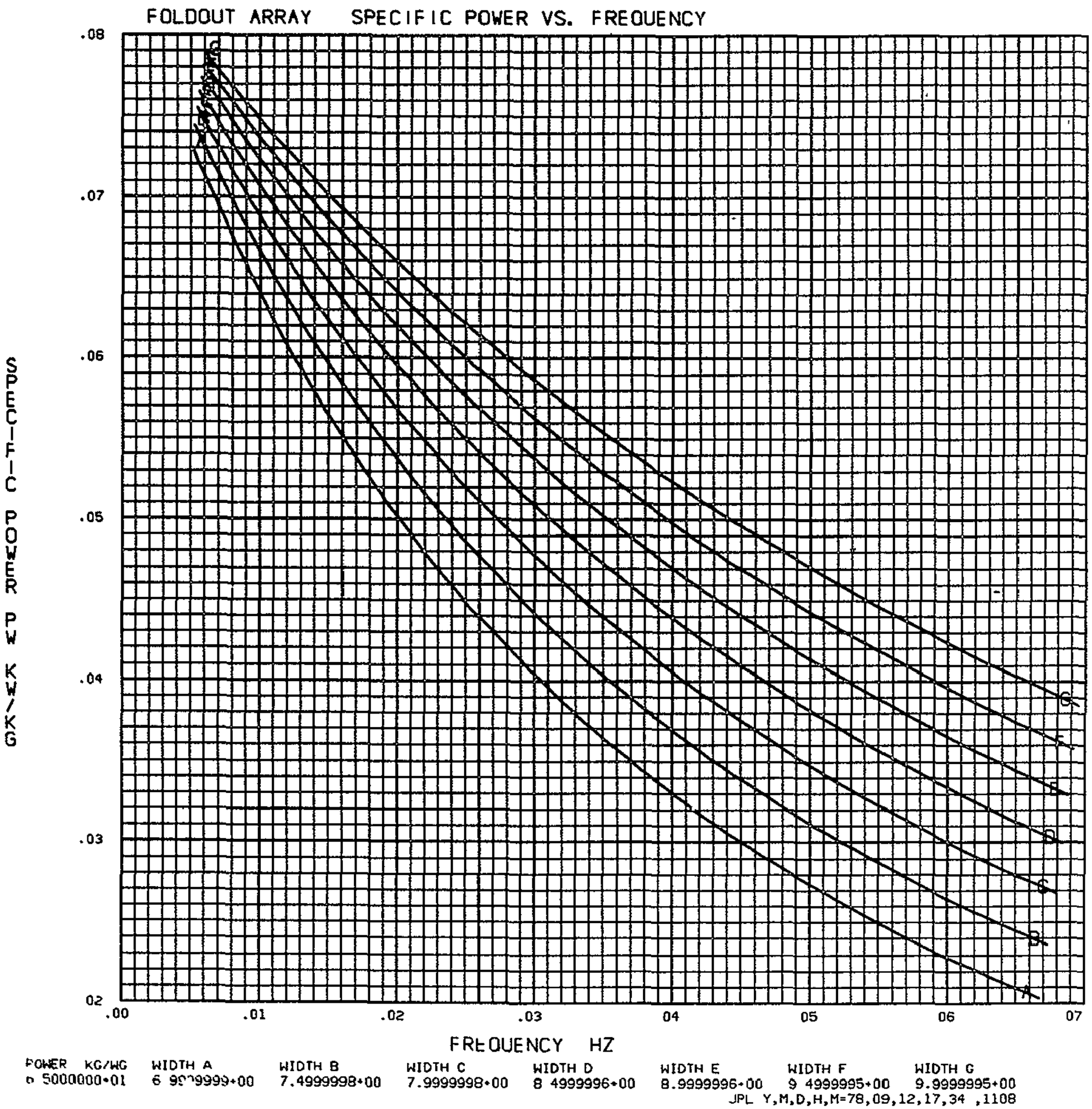


Figure 6(1). Foldout Array Specific Power vs Frequency, 65 kW/wing

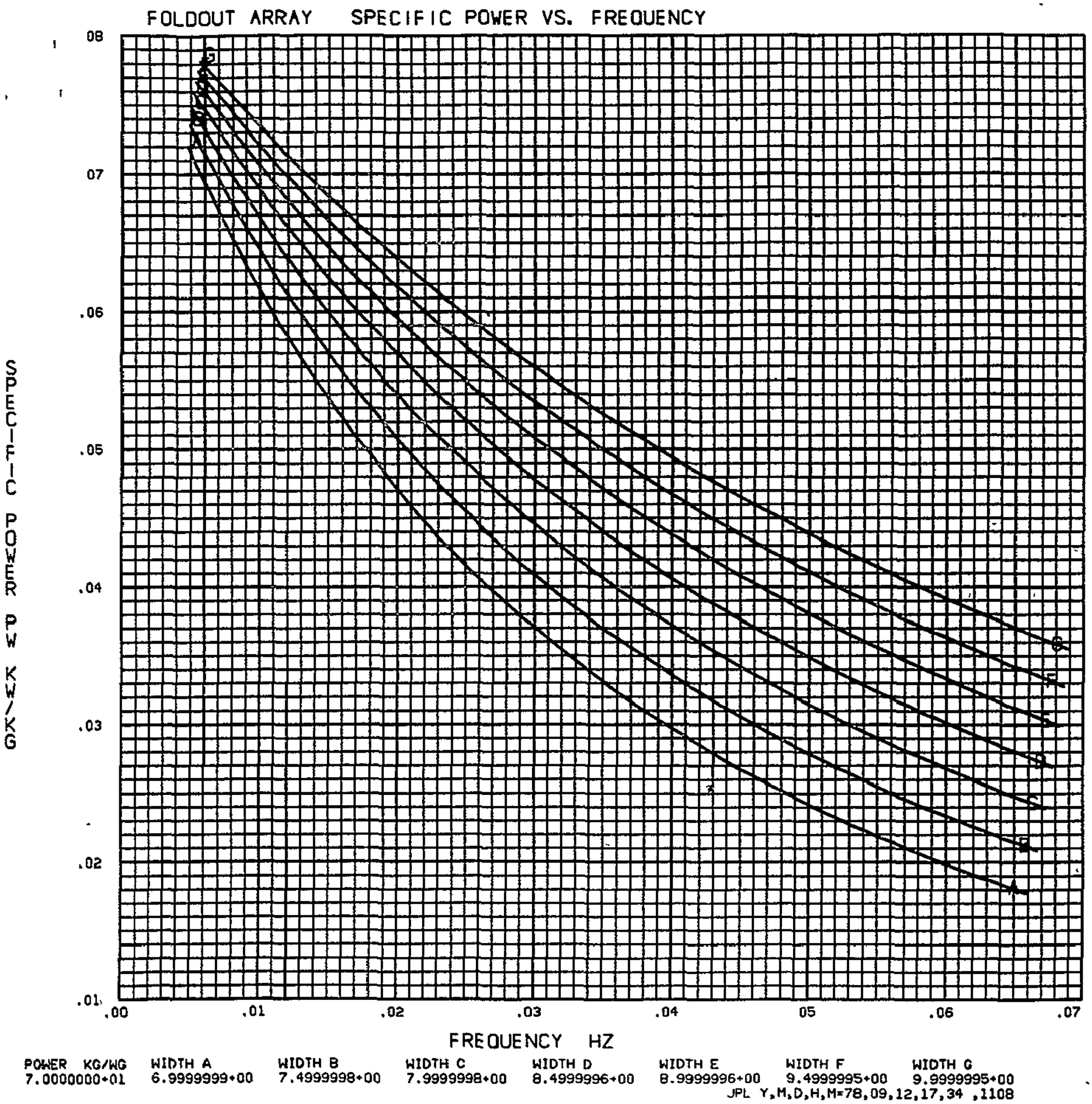
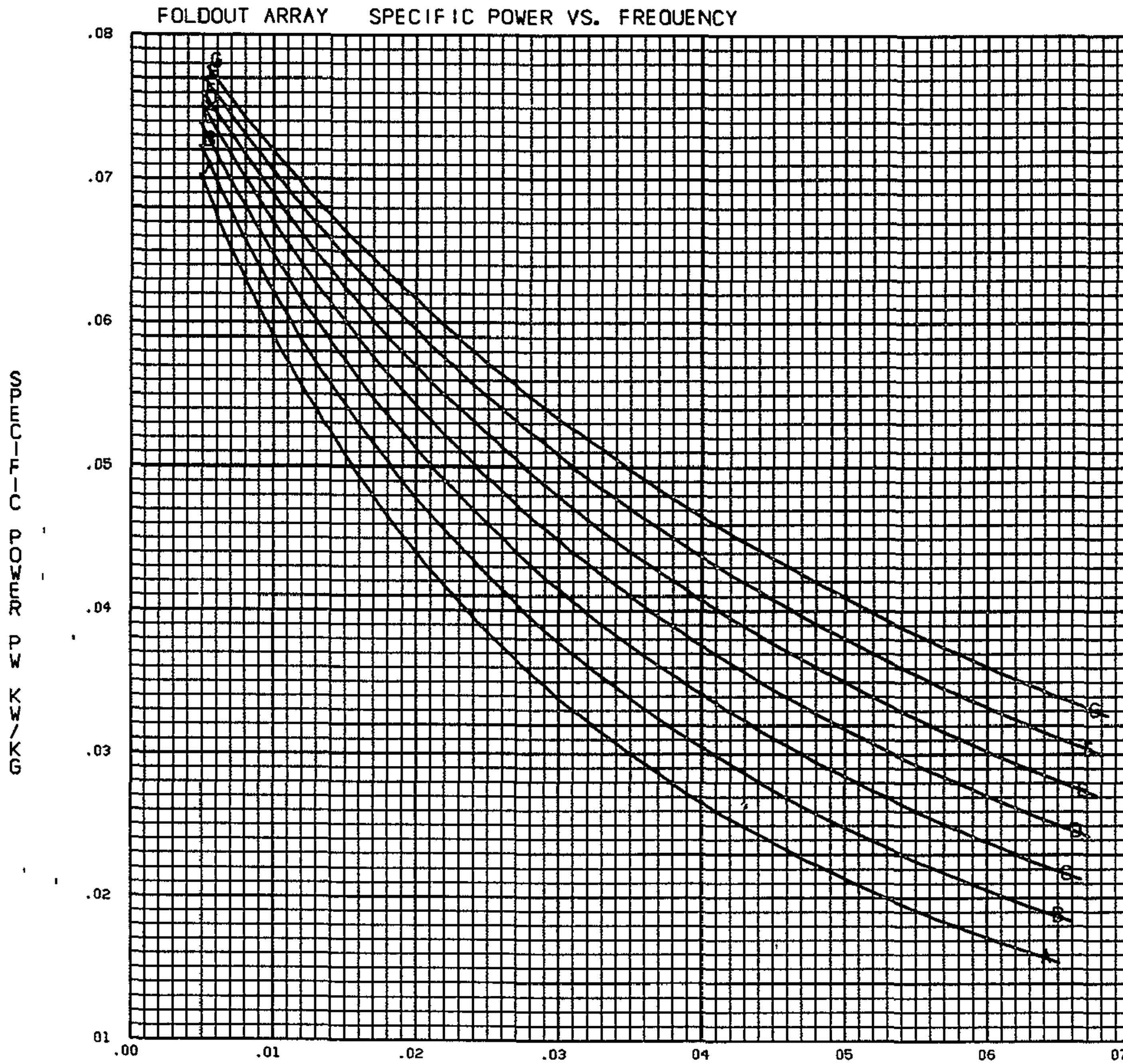


Figure 6(m). Foldout Array Specific Power vs Frequency, 70 kW/wing

ORIGINAL PAGE IS
OF POOR QUALITY



POWER KG/WG	WIDTH A	WIDTH B	WIDTH C	WIDTH D	WIDTH E	WIDTH F	WIDTH G
7 5000000+01	6 9999999+00	7 4999998+00	7 9999998+00	8 4999996+00	8 9999996+00	9.4999995+00	9.9999995+00

JPL Y,M,D,H,M=78,09,12,17,35 ,1108

Figure 6(n). Foldout Array Specific Power vs Frequency, 75 kW/wing

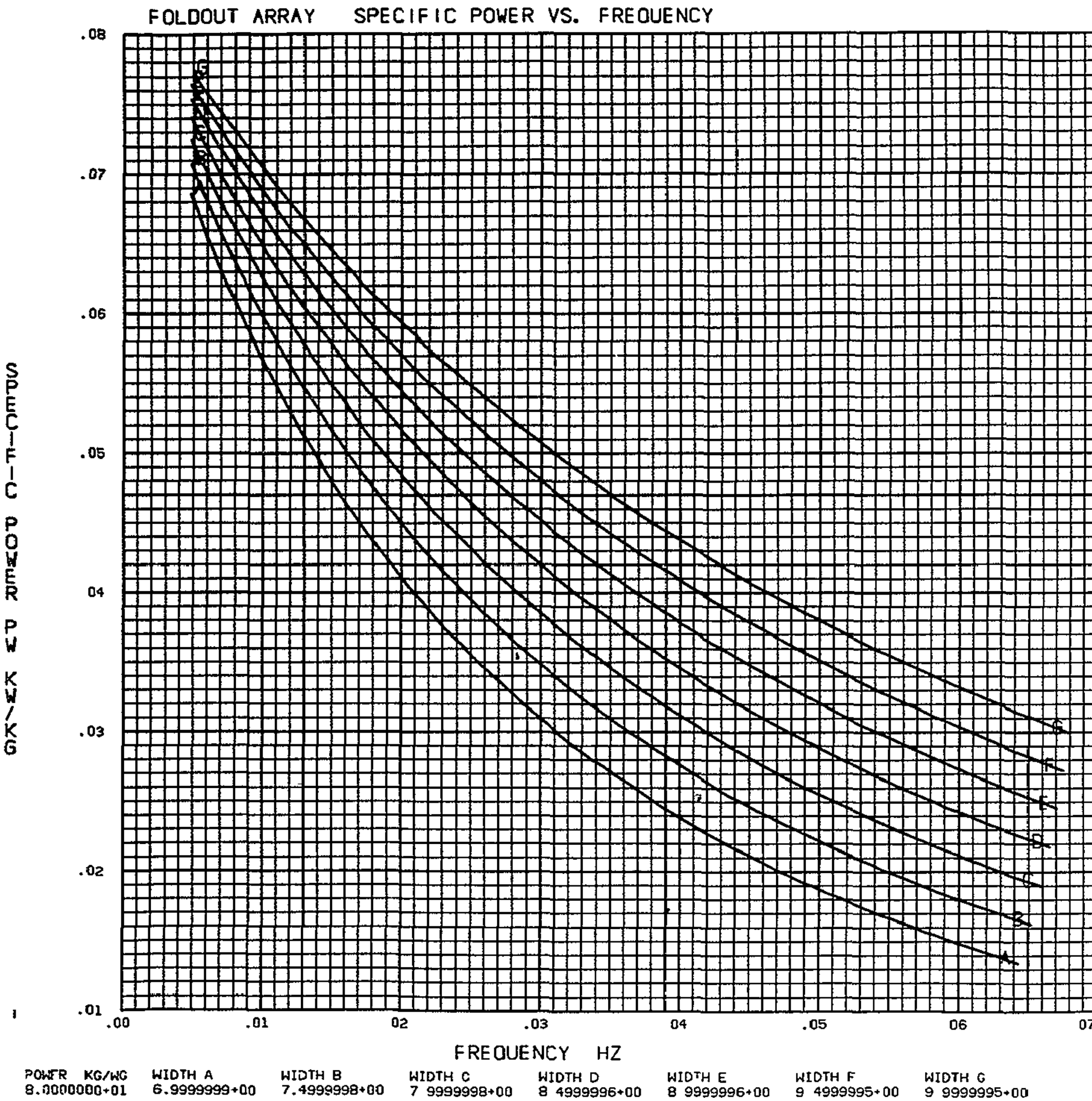


Figure 6(o). Foldout Array Specific Power vs Frequency, 80 kW/wing

ORIGINAL PAGE IS
OF POOR QUALITY

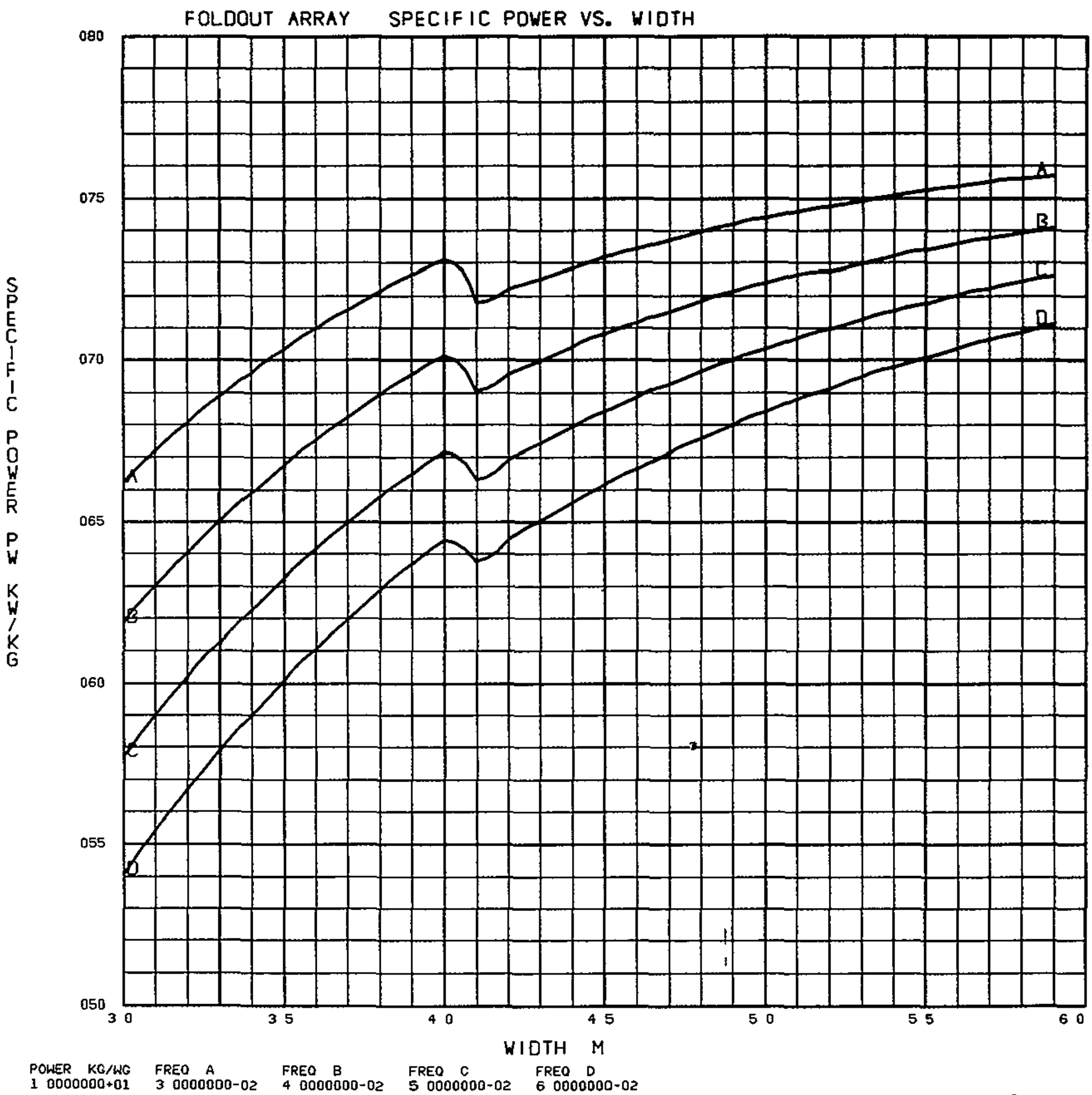


Figure 7(a). Foldout Array Specific Power vs Width, 10 kW/wing

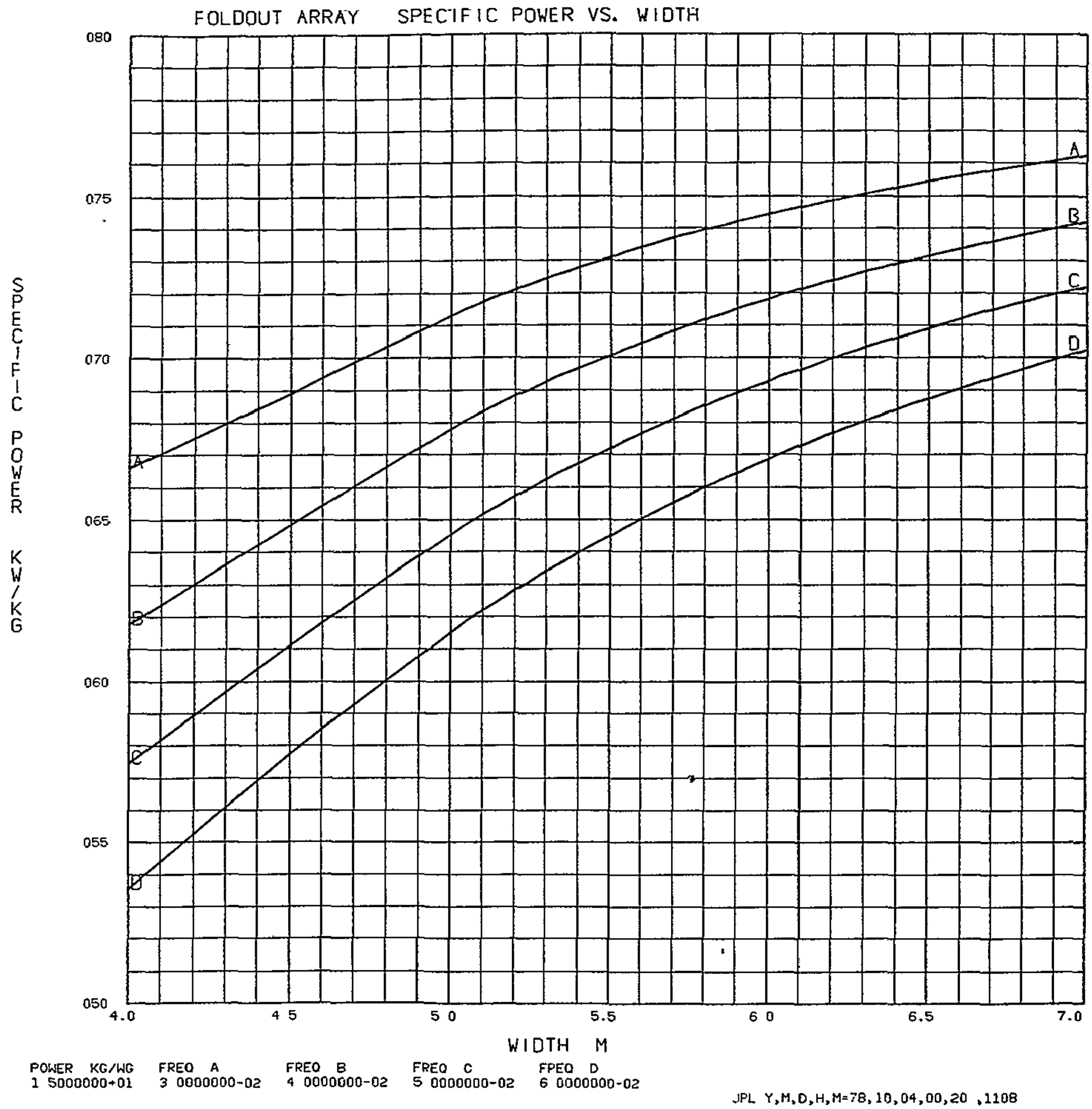


Figure 7(b). Foldout Array Specific Power vs Width, 15 kW/wing

ORIGINAL PAGE IS
OF POOR QUALITY

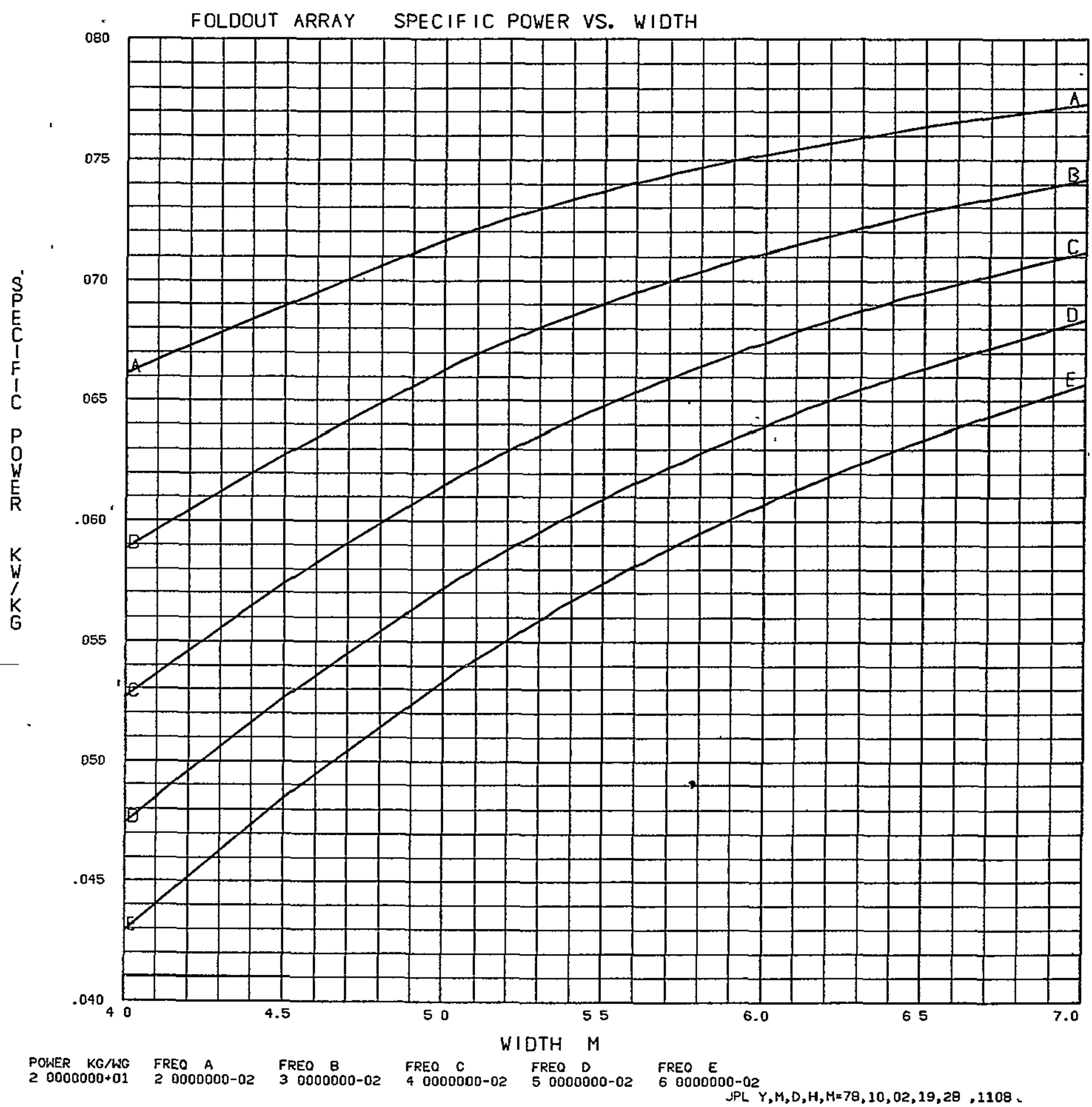


Figure 7(c). Foldout Array Specific Power vs Width, 20 kW/wing

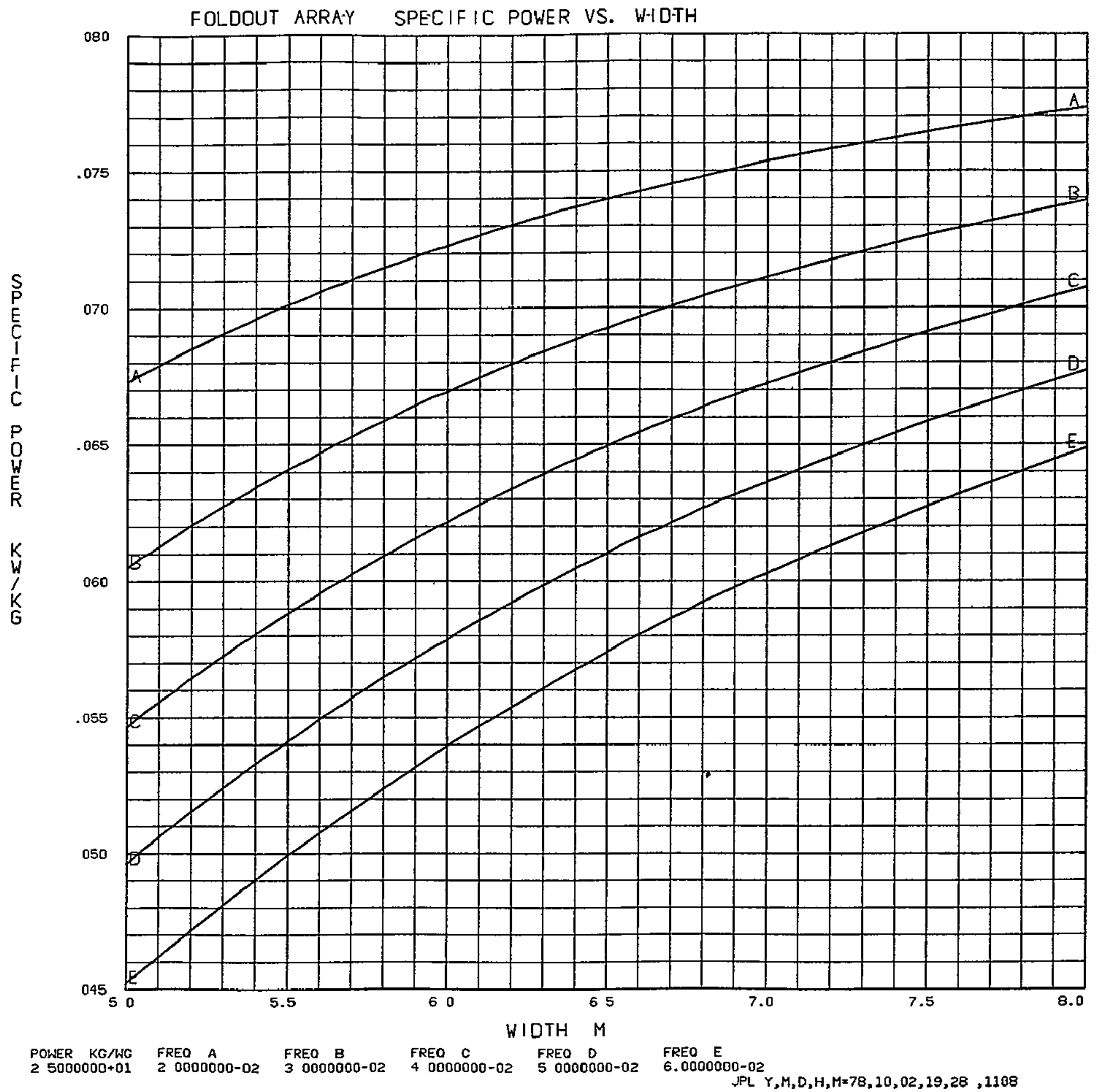


Figure 7(d). Foldout Array Specific Power vs Width, 25 kW/wing

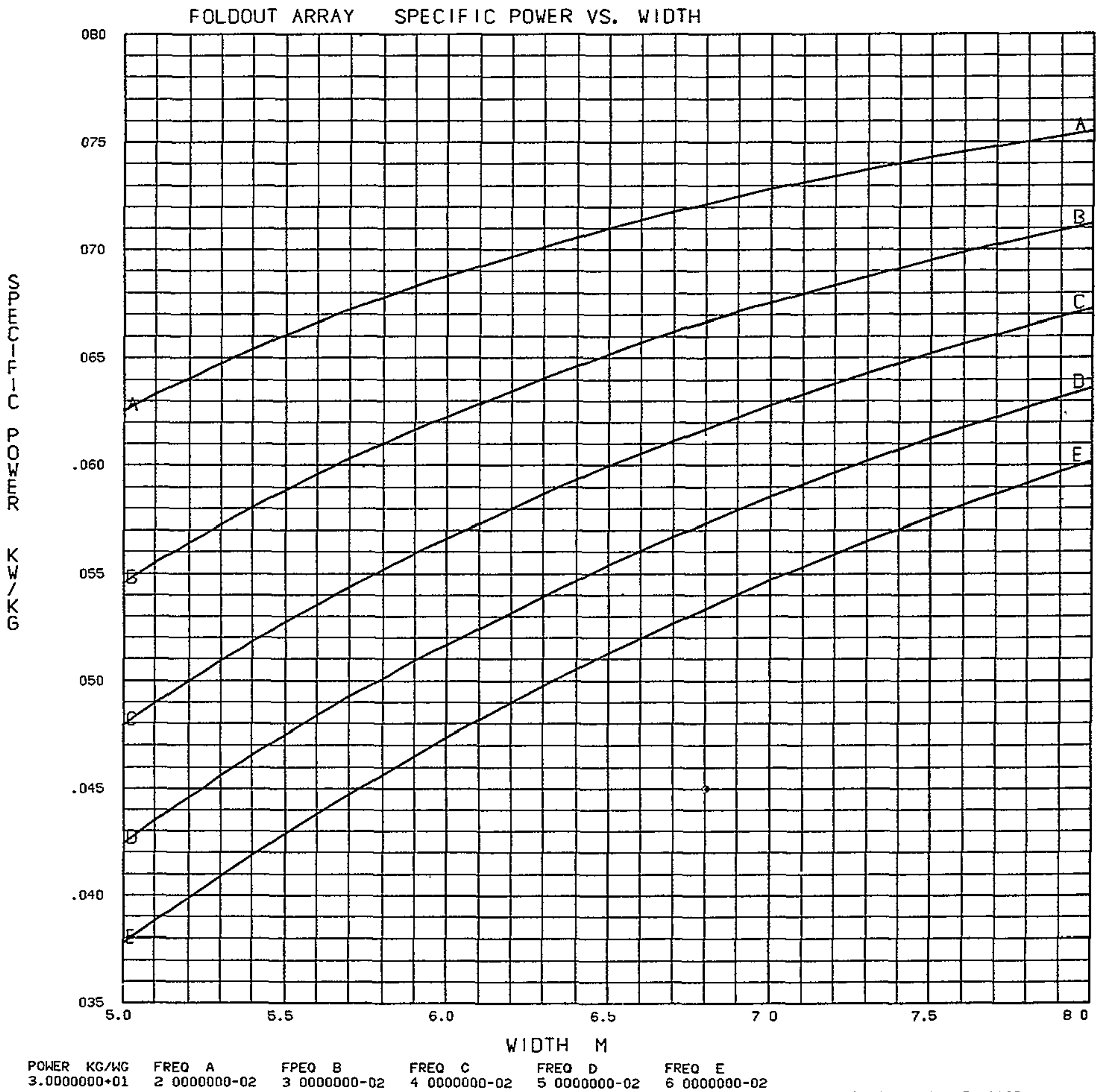


Figure 7(e). Foldout Array Specific Power vs Width, 30 kW/wing

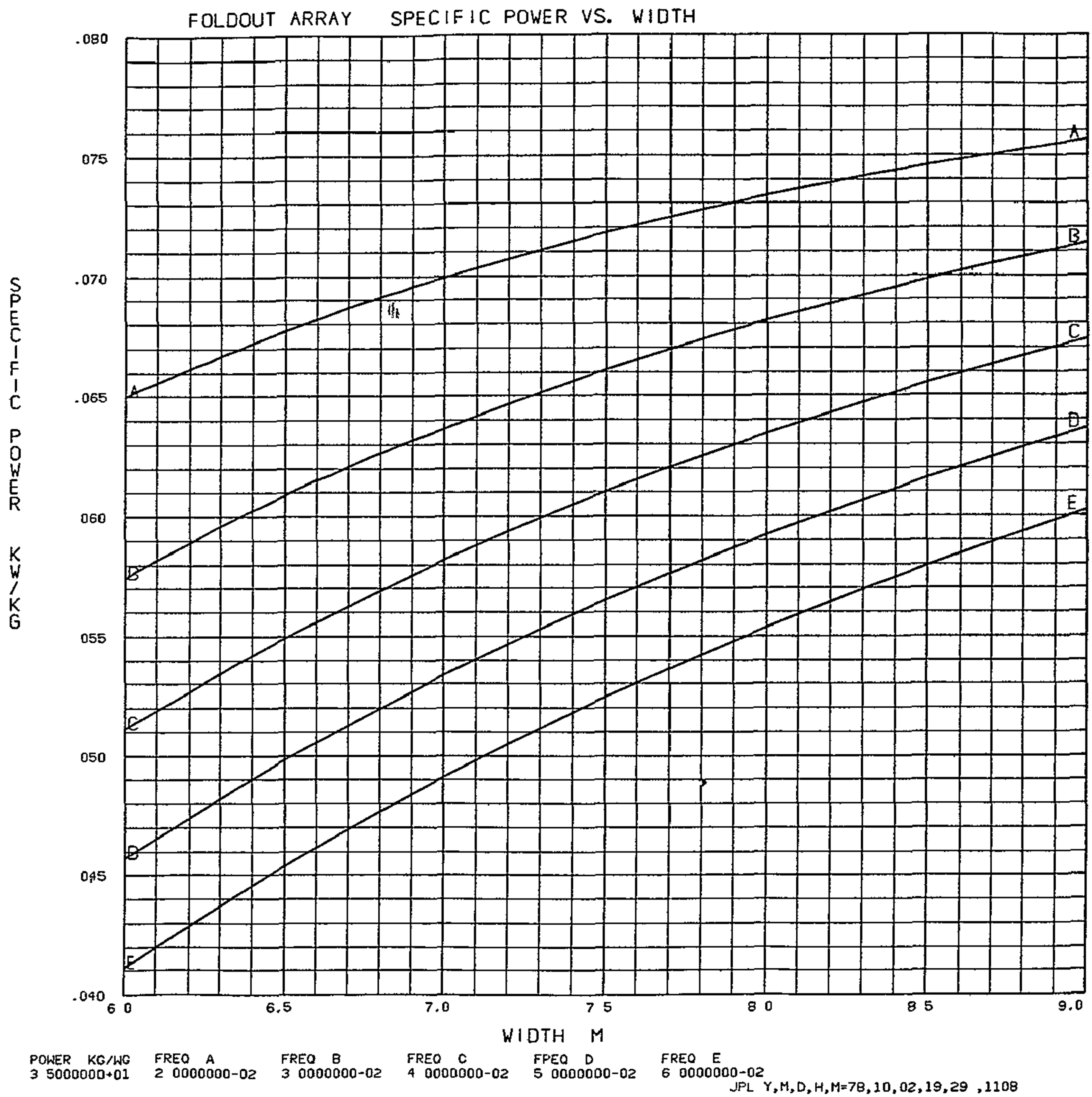


Figure 7(f). Foldout Array Specific Power vs Width, 35 kW/wing

ORIGINAL PAGE IS
OF POOR QUALITY

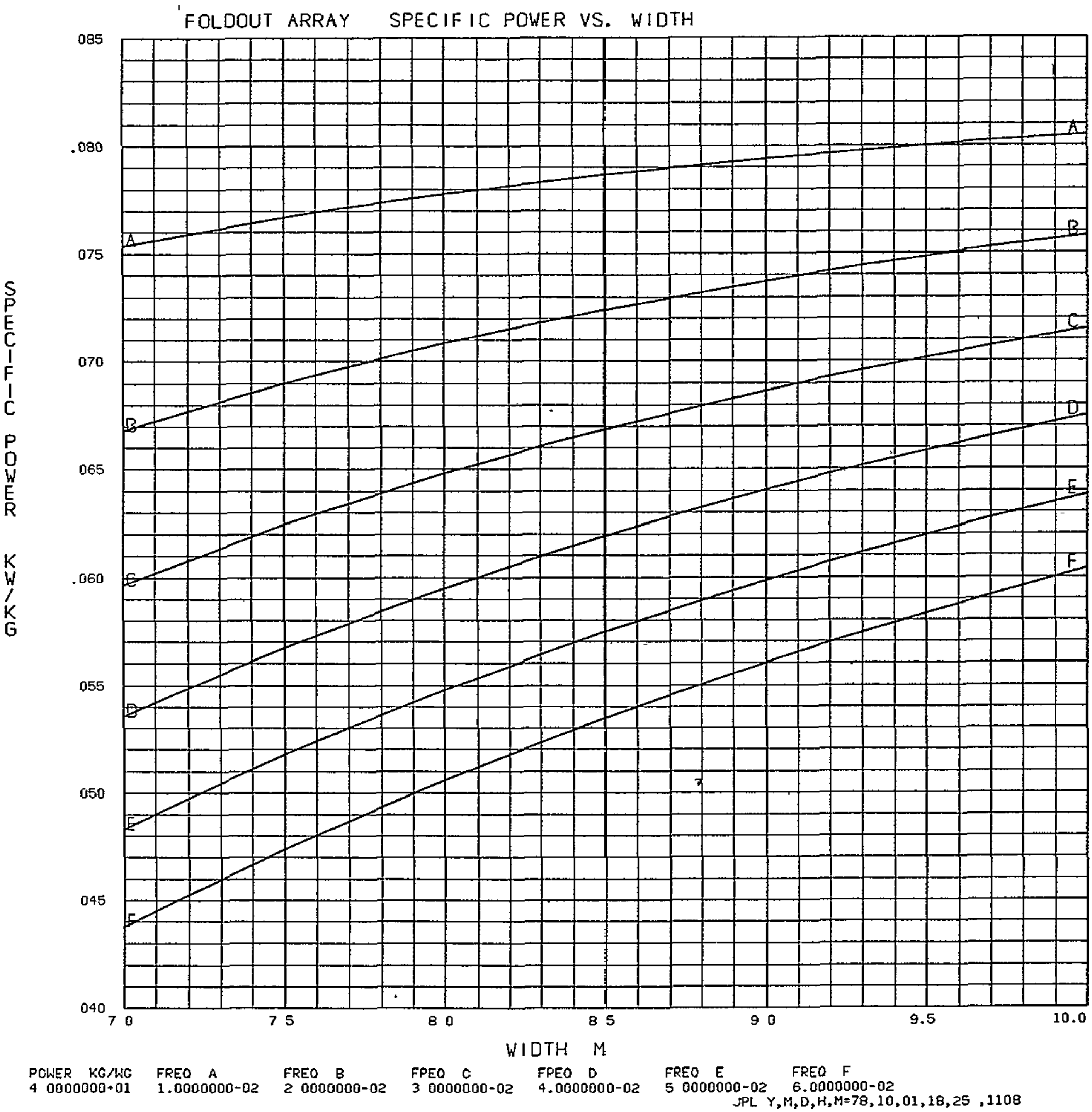


Figure 7(g). Foldout Array Specific Power vs Width, 40 kW/wing

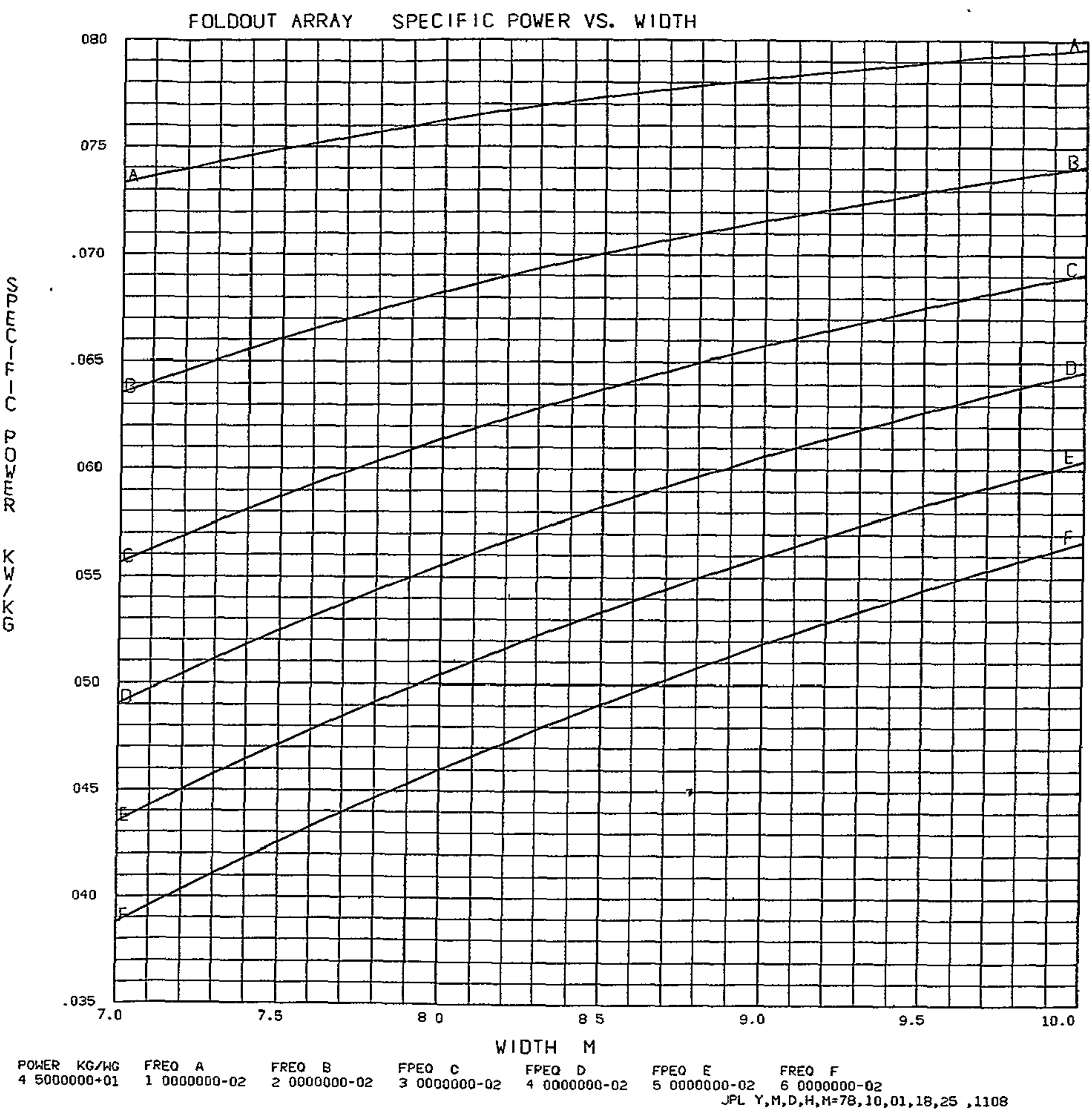


Figure 7(h). Foldout Array Specific Power vs Width, 45 kW/wing

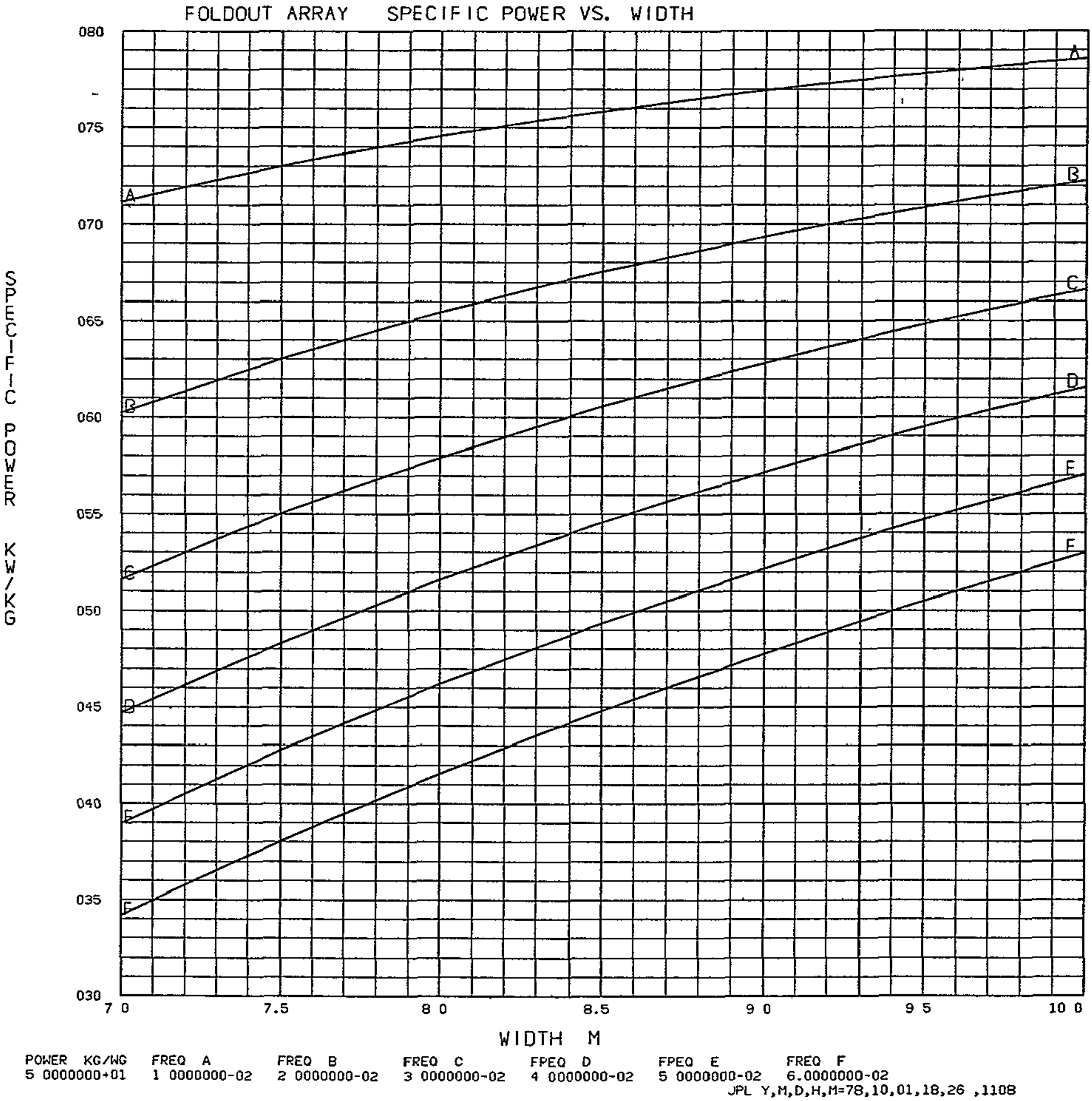


Figure 7(i). Foldout Array Specific Power vs Width, 50 kW/wing

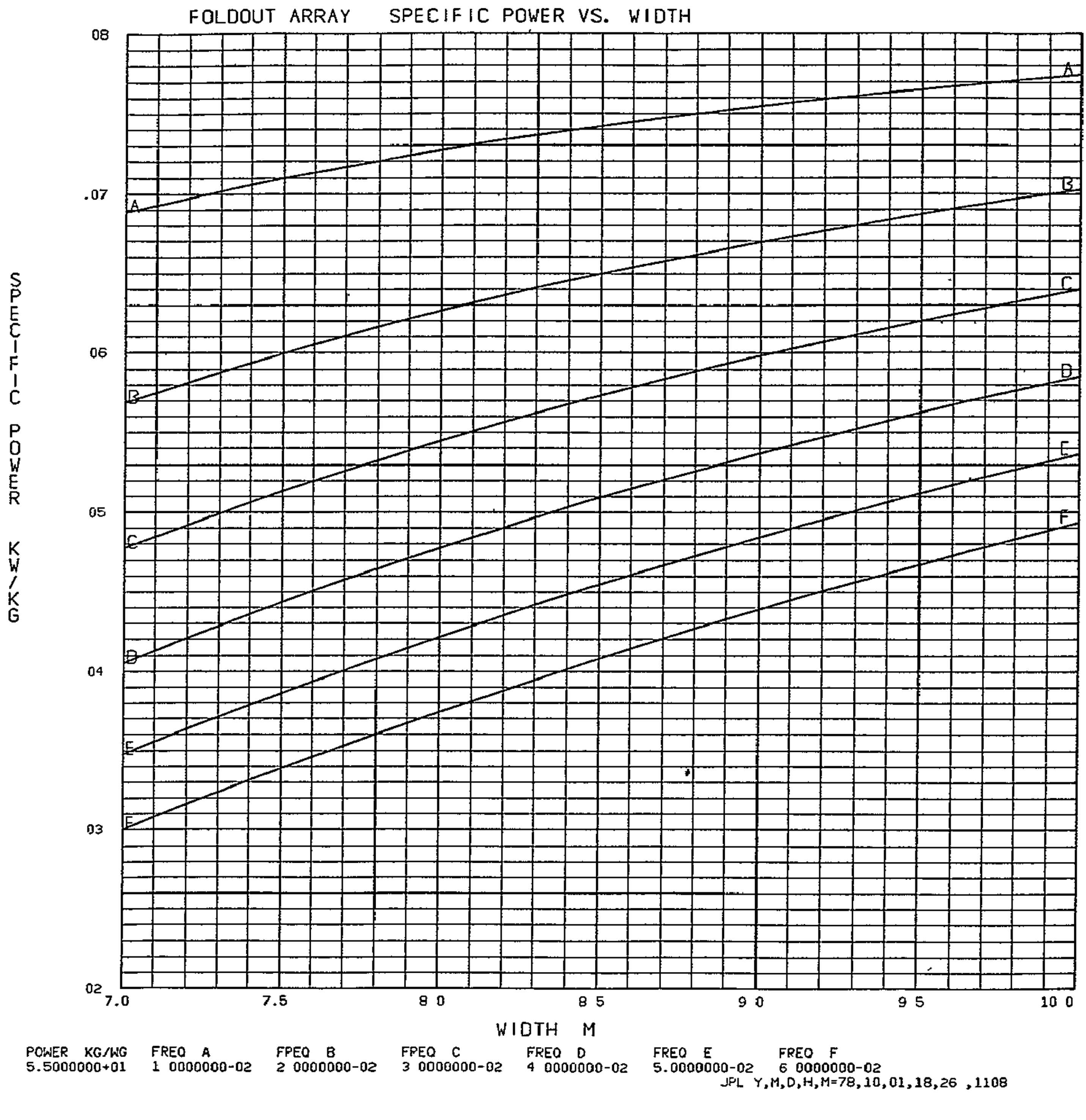


Figure 7(j). Foldout Array Specific Power vs Width, 55 kW/wing

ORIGINAL PAGE IS
OF POOR QUALITY

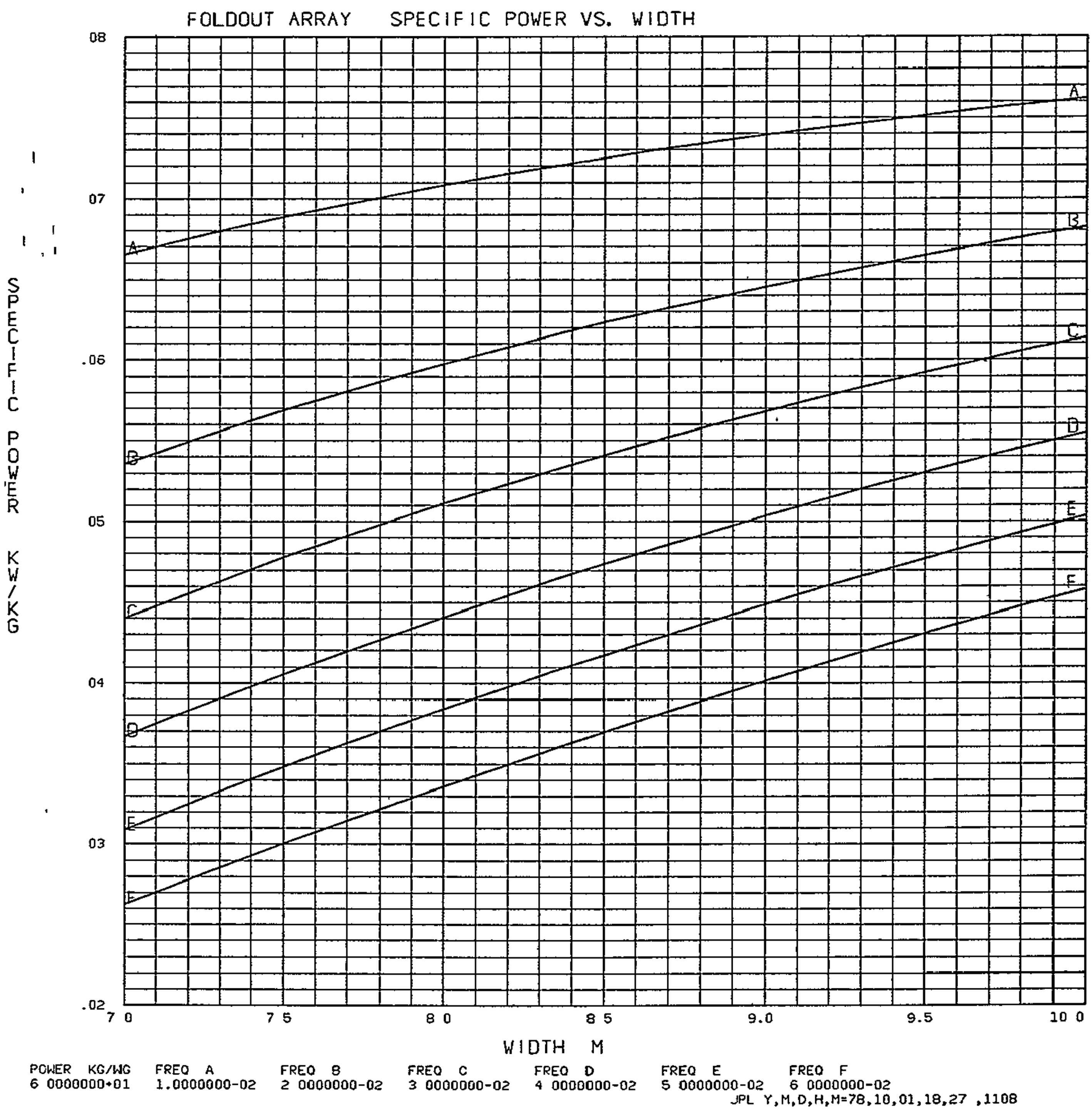


Figure 7(k). Foldout Array Specific Power vs Width, 60 kW/wing

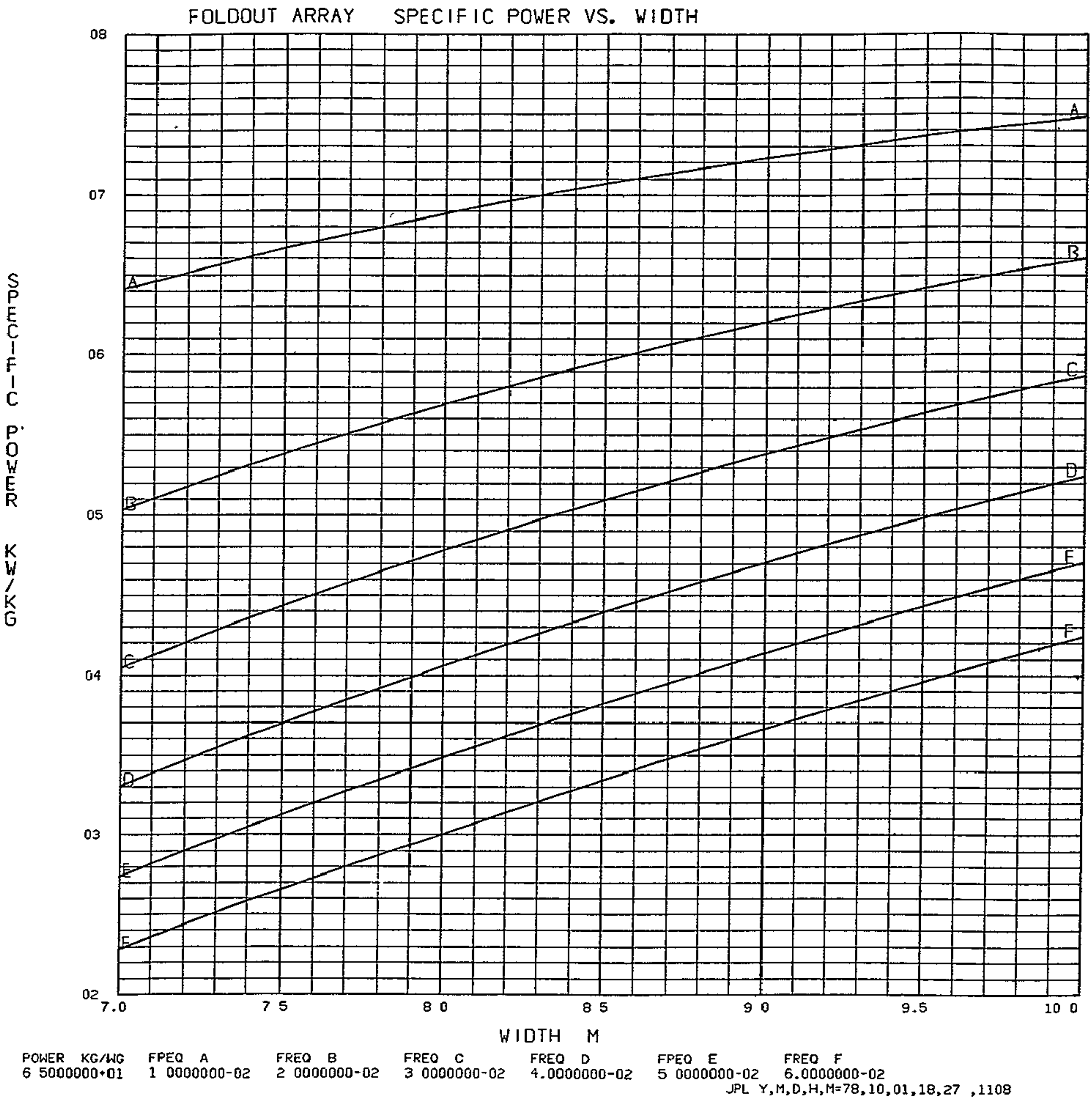


Figure 7(1). Foldout Array Specific Power vs Width, 65 kW/wing

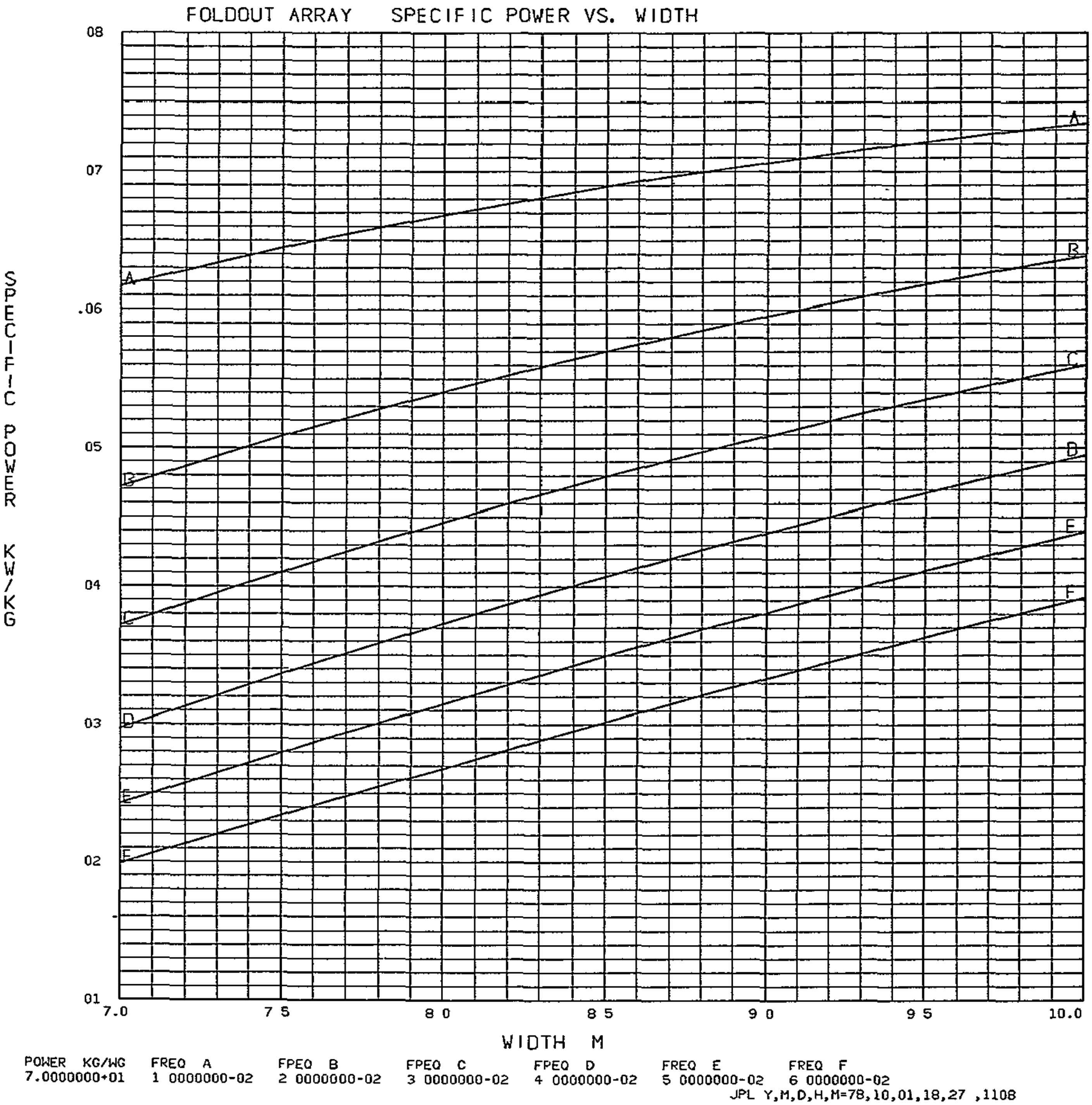


Figure 7(m). Foldout Array Specific Power vs Width, 70 kW/wing

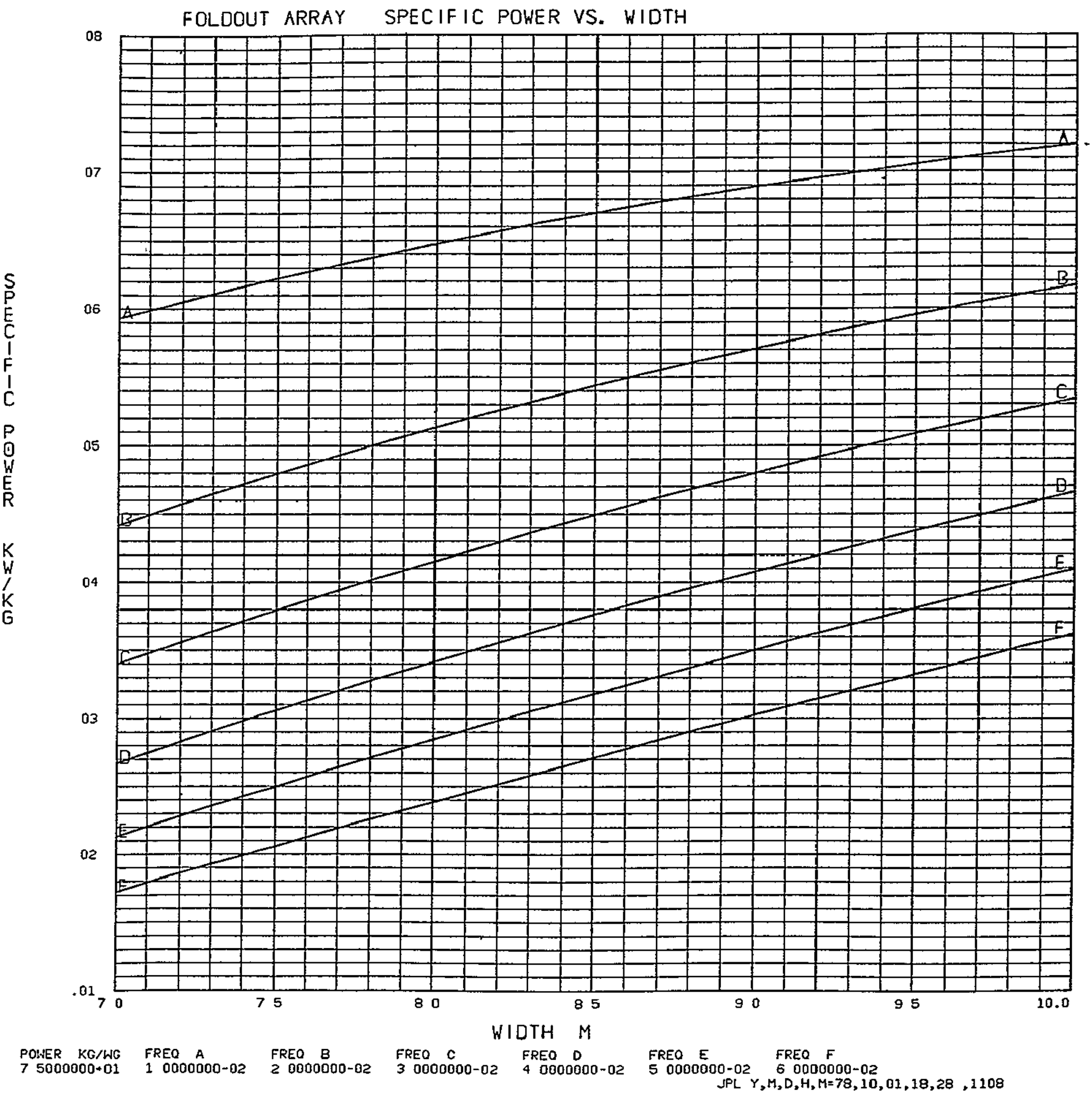


Figure 7(n). Foldout Array Specific Power vs Width, 75 kW/wing

ORIGINAL PAGE IS
OF POOR QUALITY

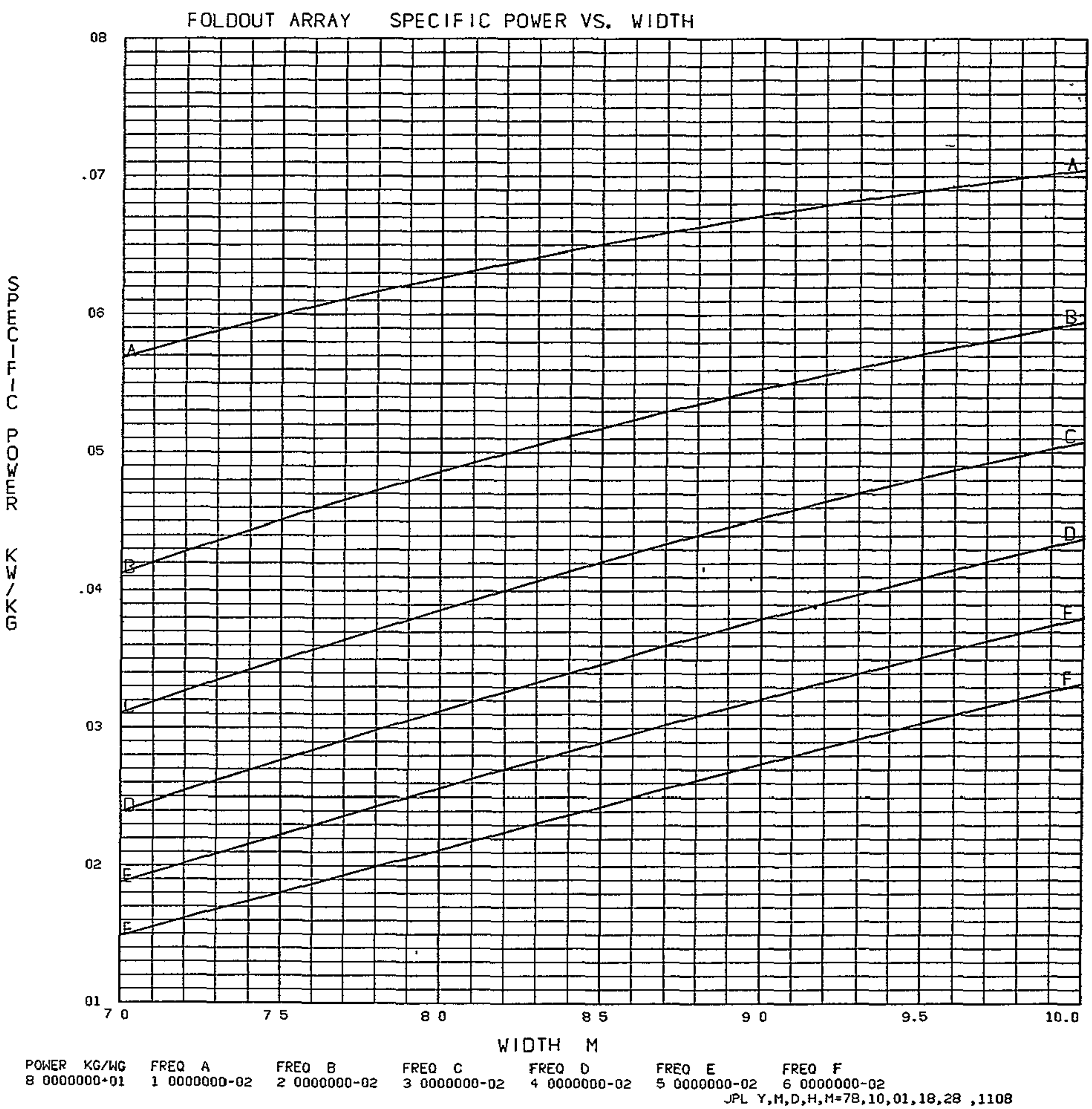


Figure 7(o). Foldout Array Specific Power vs Width, 80 kW/wing

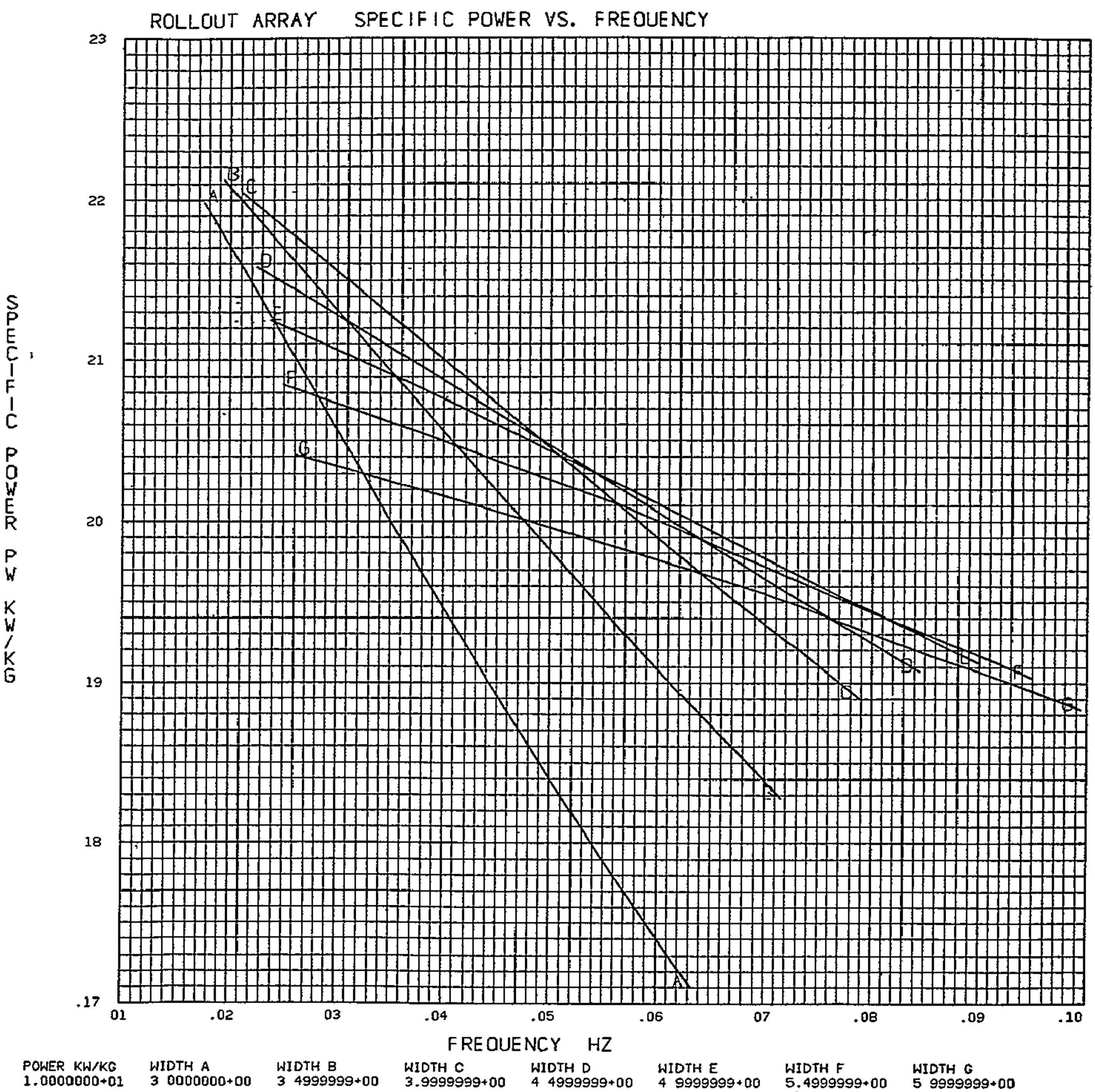


Figure 8(a). Rollout Array Specific Power vs Frequency, 10 kW/wing

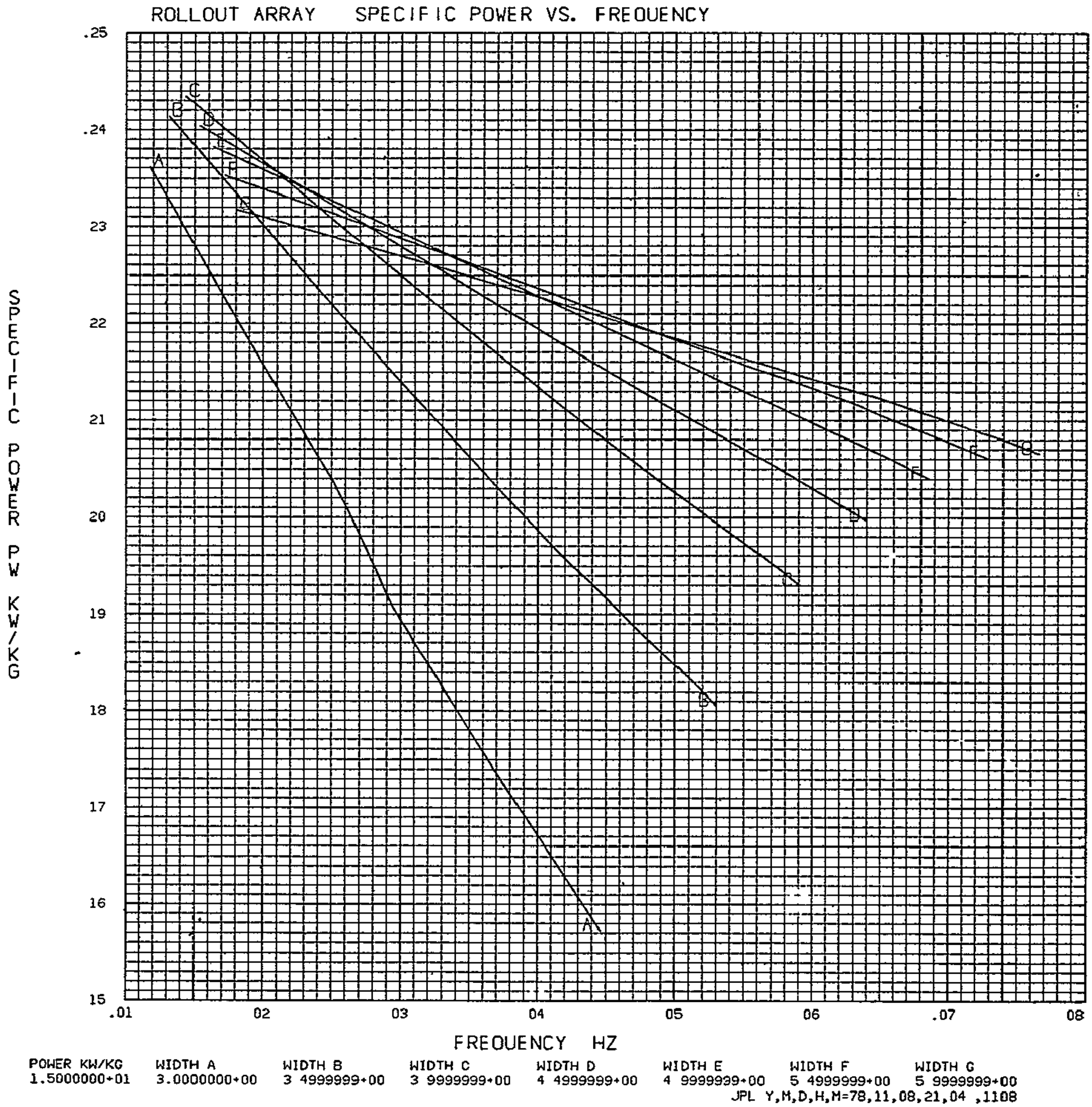


Figure 8(b). Rollout Array Specific Power vs Frequency, 15 kW/wing

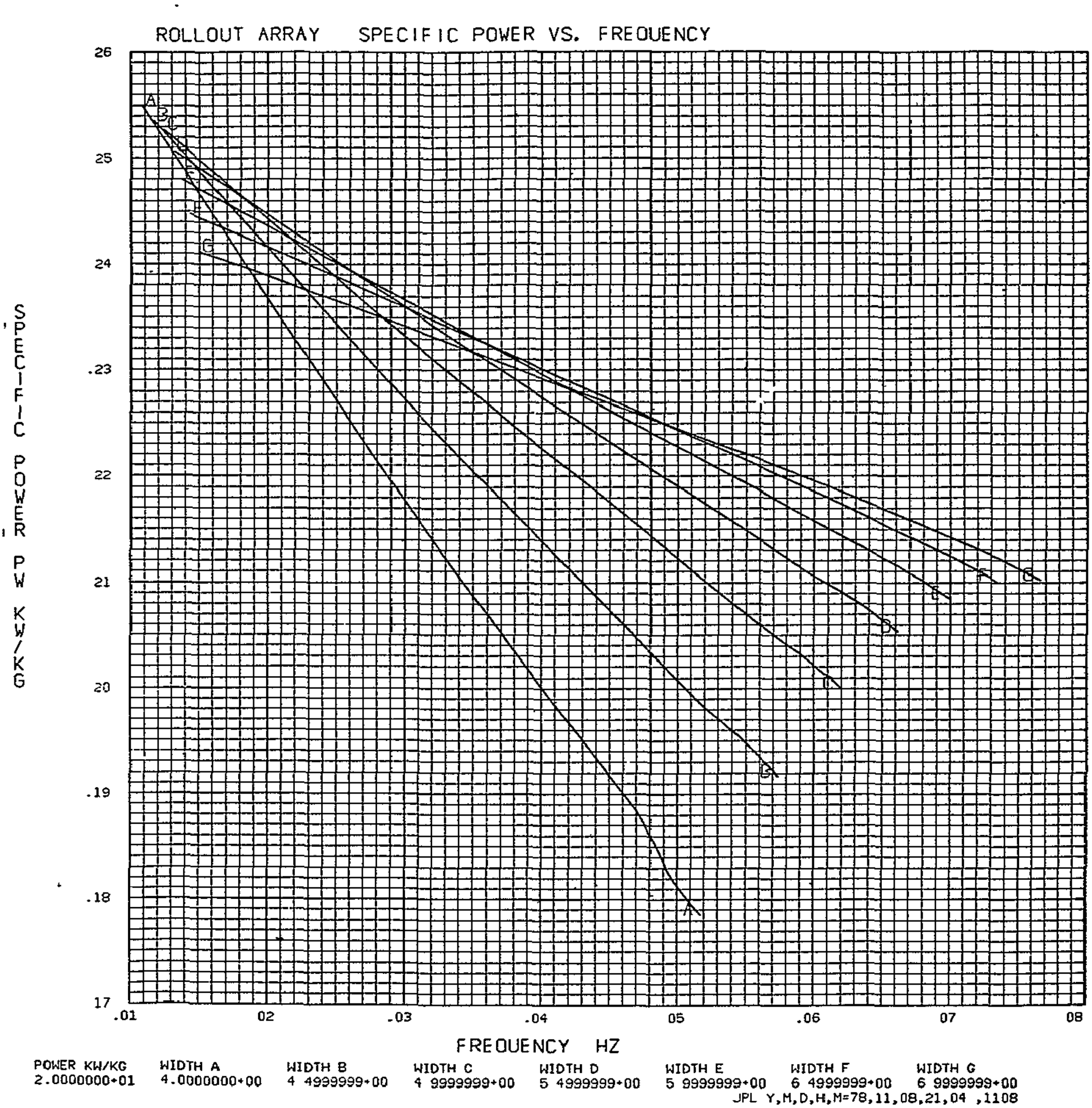
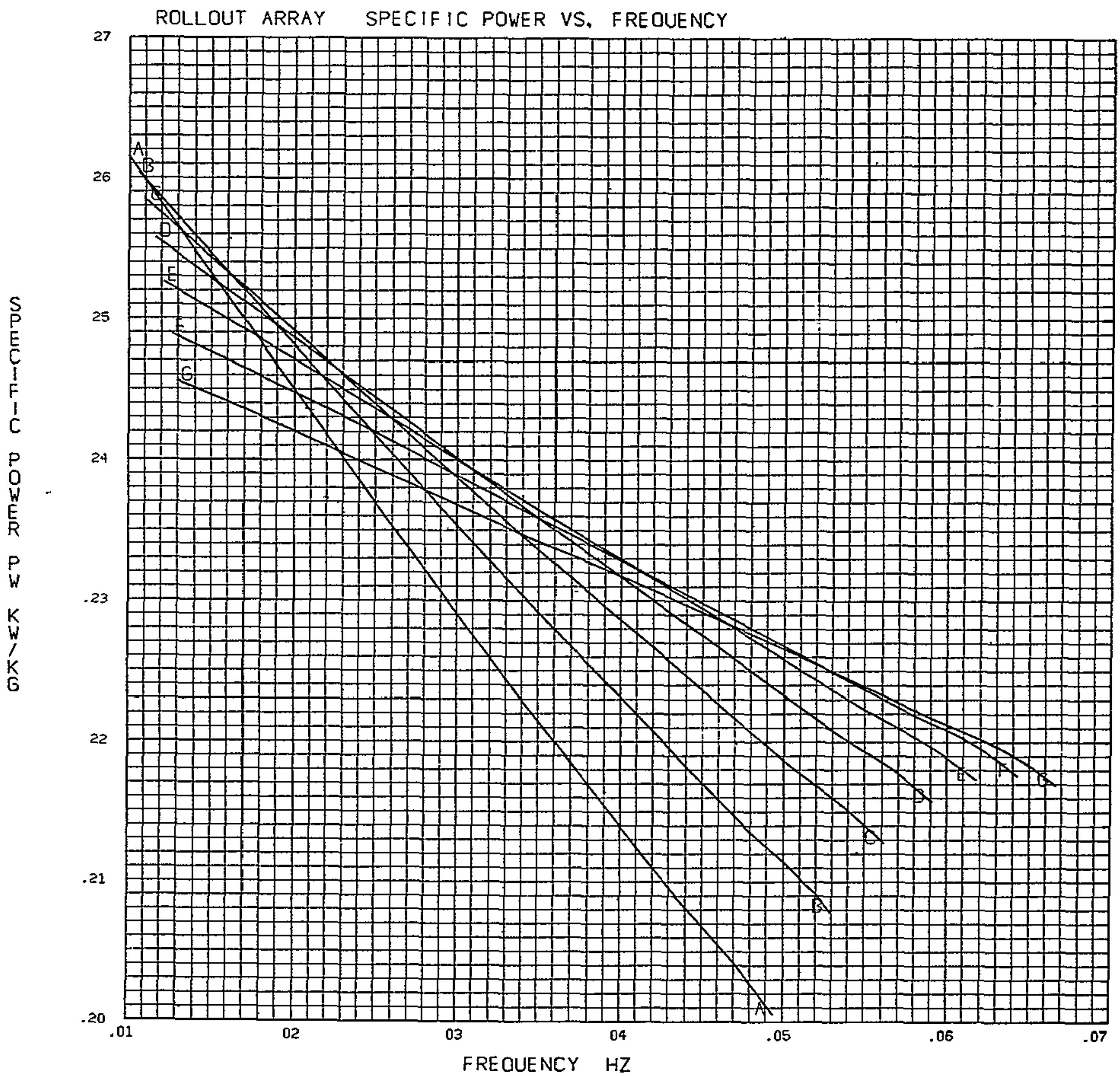


Figure 8(c). Rollout Array Specific Power vs Frequency, 20 kW/wing



POWER KW/KG	WIDTH A	WIDTH B	WIDTH C	WIDTH D	WIDTH E	WIDTH F	WIDTH G
2 5000000+01	4 9999999+00	5 4999999+00	5 9999999+00	6 4999999+00	6 9999999+00	7 4999998+00	7 9999998+00

JPL Y,M,D,H,M=78,11,08,21,04 ,1108

Figure 8(d). Rollout Array Specific Power vs Frequency, 25 kW/wing

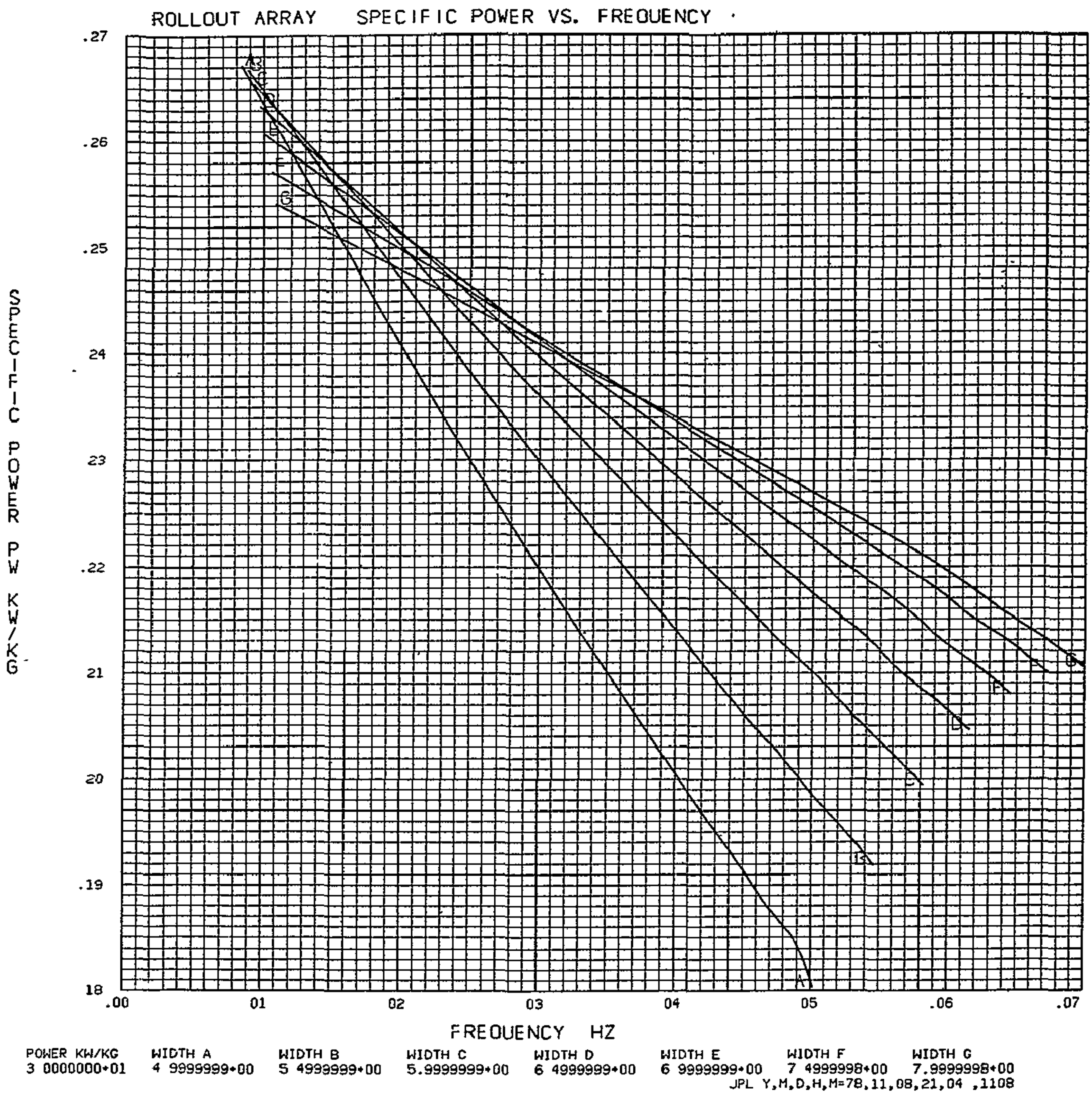


Figure 8(e). Rollout Array Specific Power vs Frequency, 30 kW/wing

ORIGINAL PAGE IS
OF POOR QUALITY

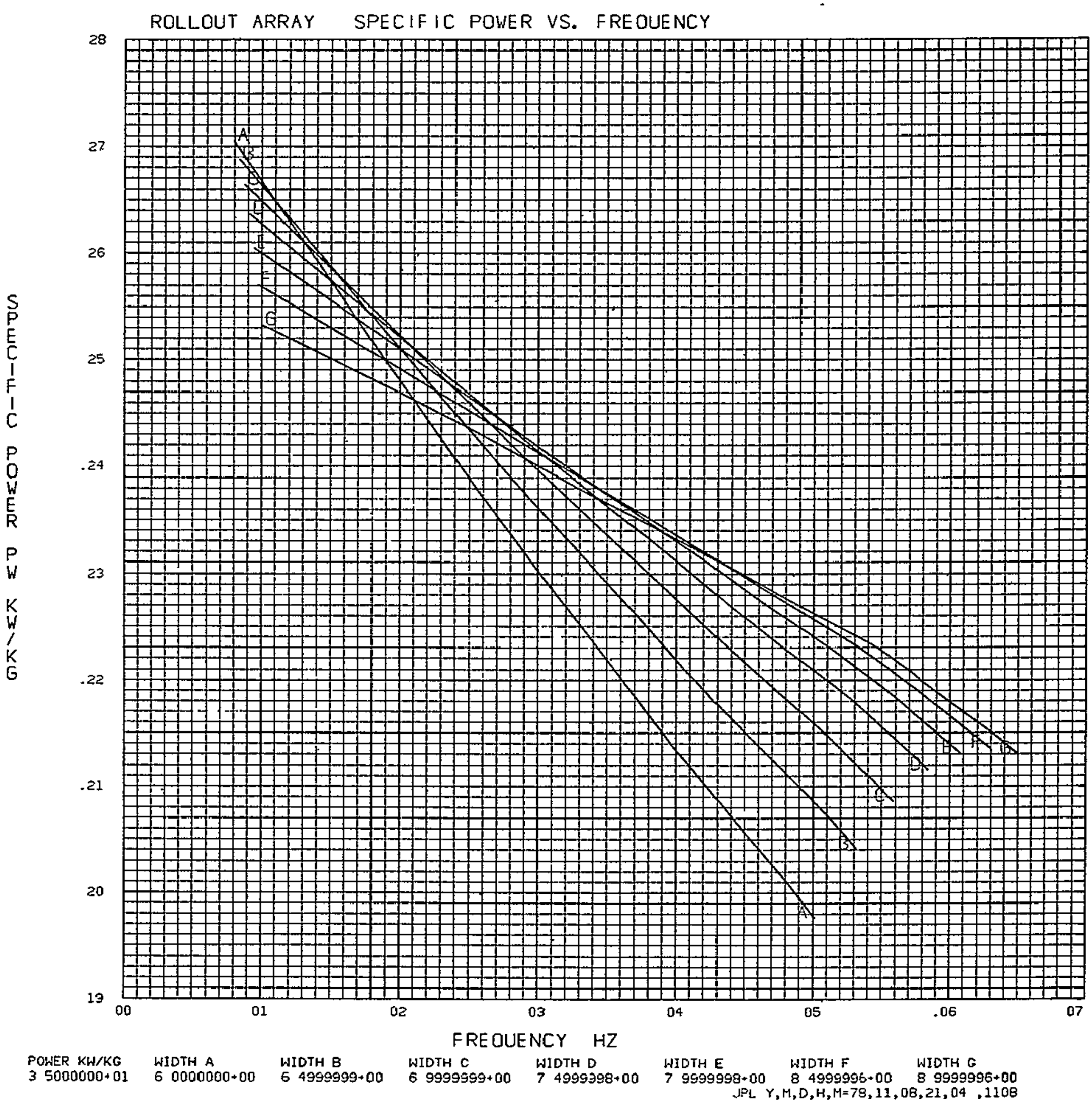


Figure 8(f). Rollout Array Specific Power vs Frequency, 35 kW/wing

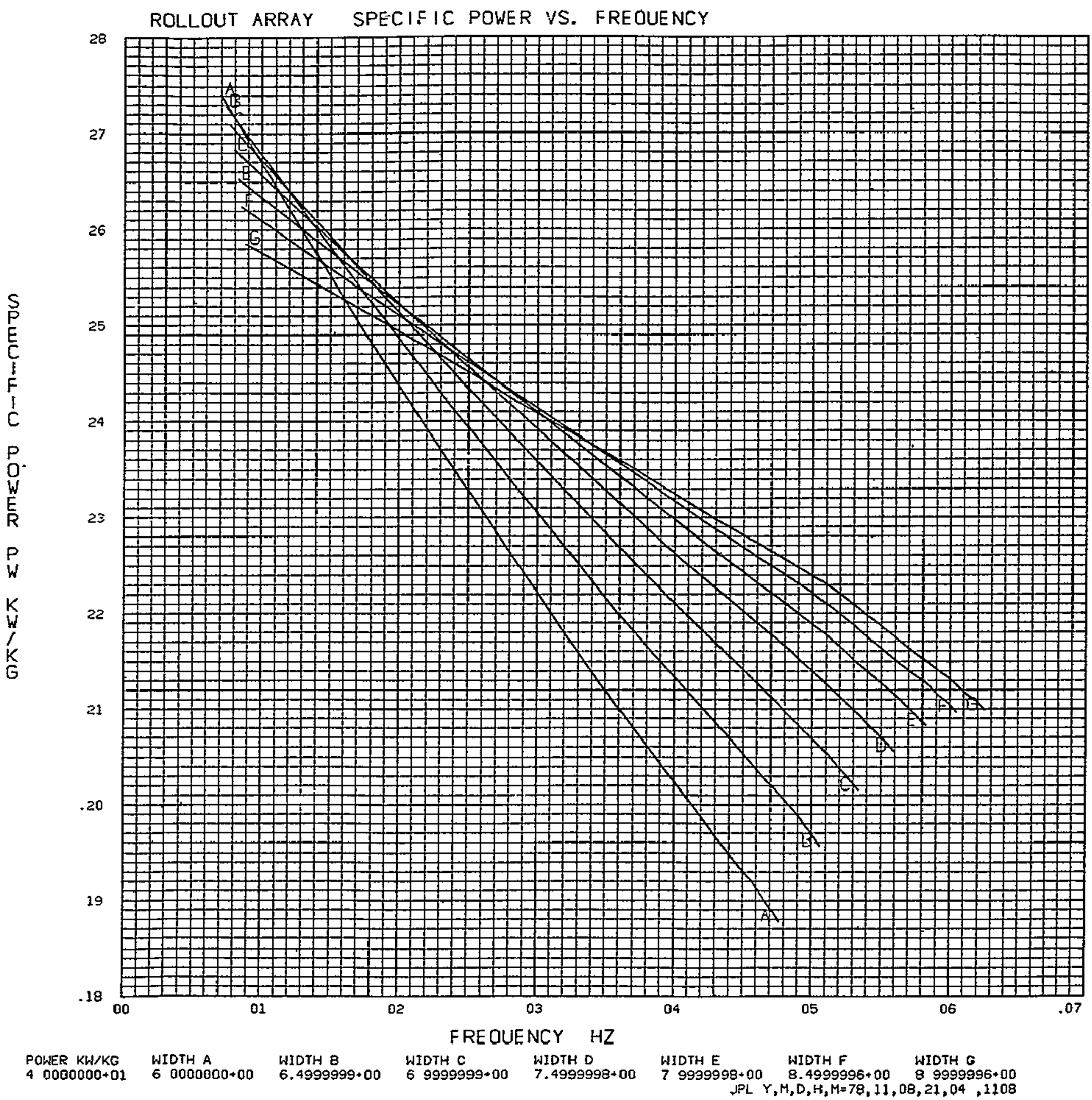


Figure 8(g). Rollout Array Specific Power vs Frequency, 40 kW/wing

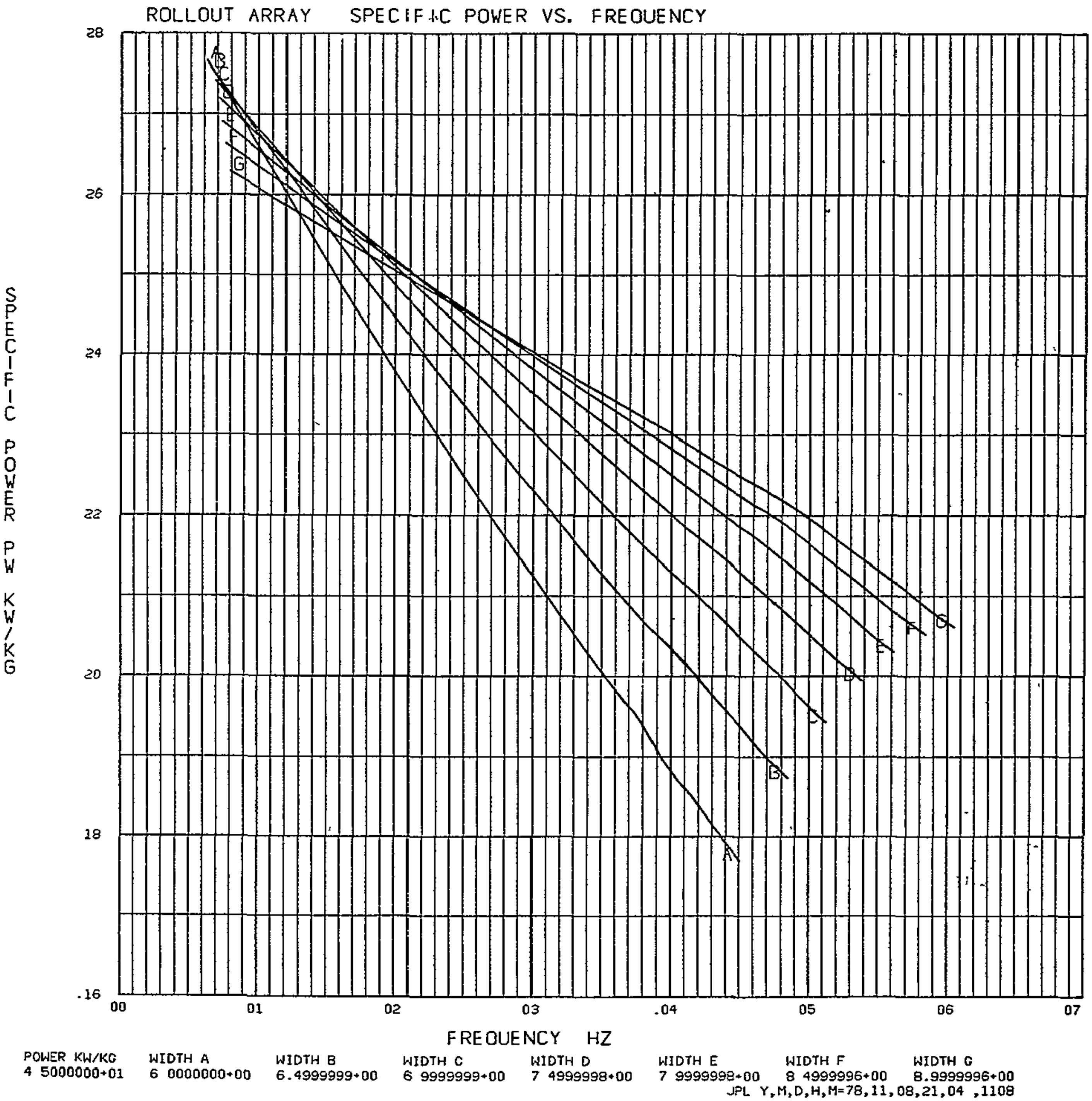
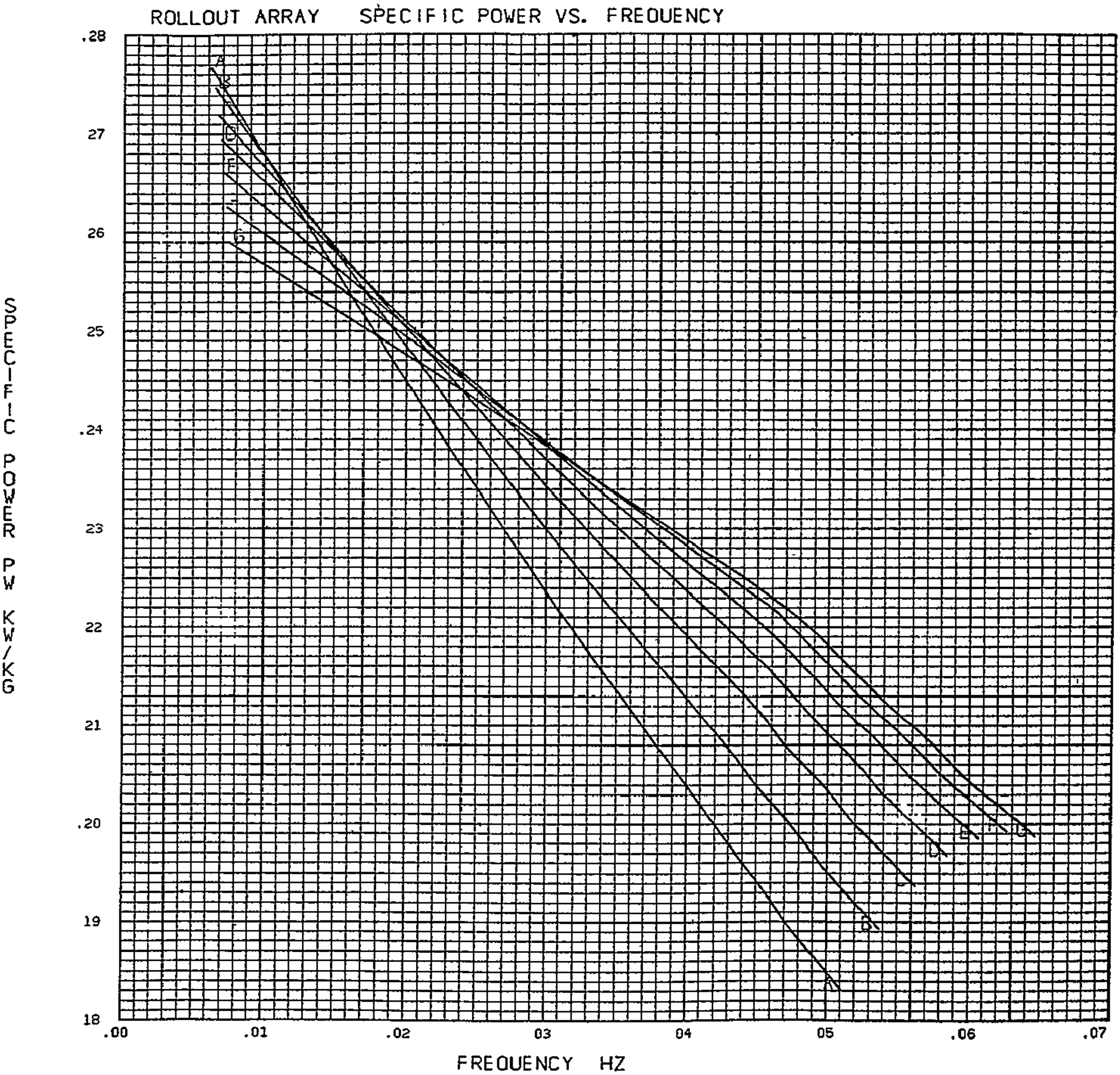


Figure 8(h). Rollout Array Specific Power vs Frequency, 45 kW/wing

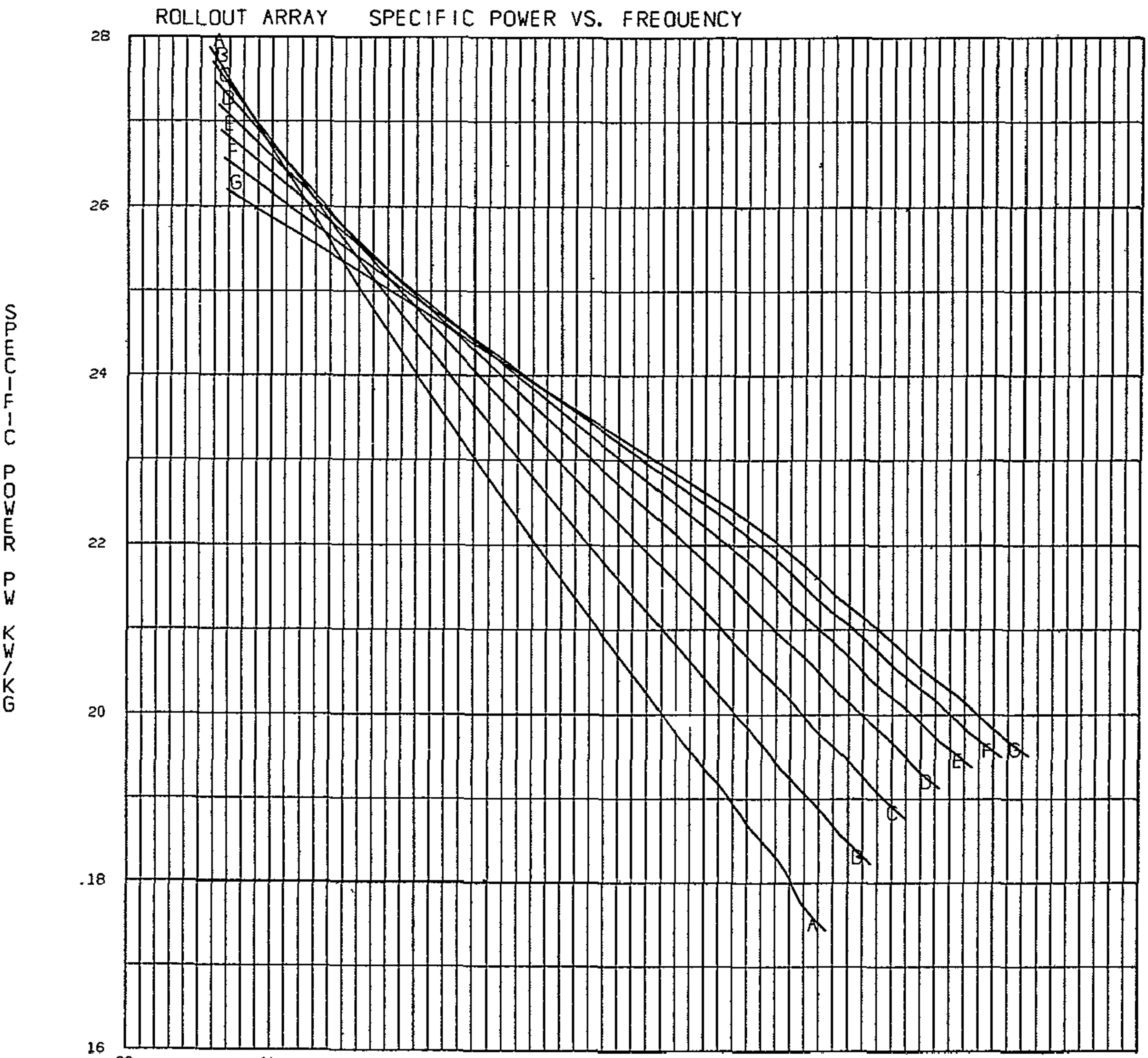


POWER KW/KG	WIDTH A	WIDTH B	WIDTH C	WIDTH D	WIDTH E	WIDTH F	WIDTH G
5 0000000+01	6.9999999+00	7 4999998+00	7.9999998+00	8 4999996+00	8 9999996+00	9.4999995+00	9.9999995+00

JPL Y,M,D,H,M=78,11,08,21,05 ,1108

Figure 8(i). Rollout Array Specific Power vs Frequency, 50 kW/wing

ORIGINAL PAGE IS
OF POOR QUALITY



POWER KW/KG	WIDTH A	WIDTH B	WIDTH C	WIDTH D	WIDTH E	WIDTH F	WIDTH G
5 5000000+01	6 9999999+00	7.4999998+00	7 9999998+00	8 4999996+00	8 9999996+00	9 4999995+00	9.9999995+00

JPL Y,M,D,H,M=78,11,08,21,05 ,1108

Figure 8(j). Rollout Array Specific Power vs Frequency, 55 kW/wing

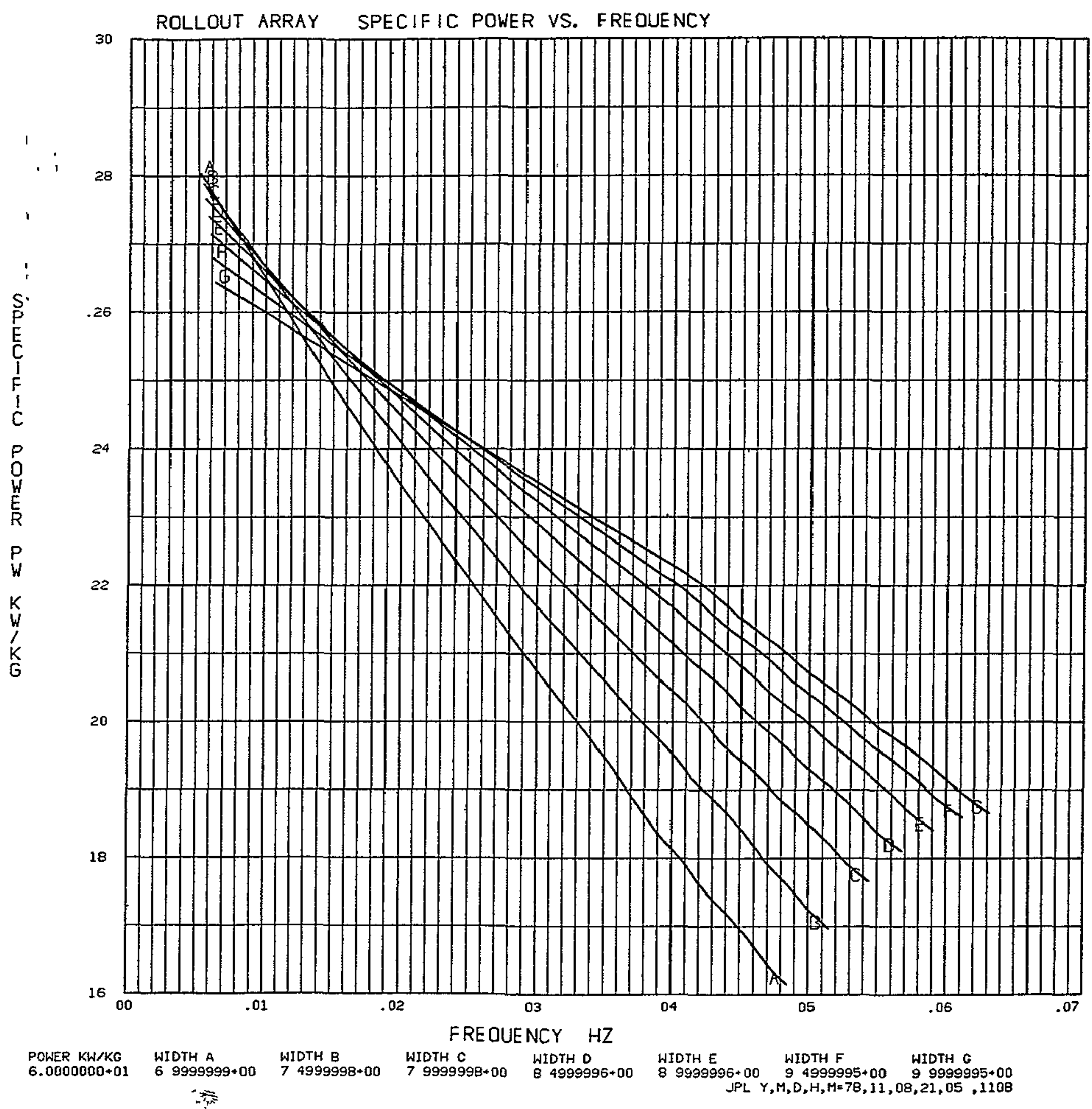


Figure 8(k). Rollout Array Specific Power vs Frequency, 60 kW/wing

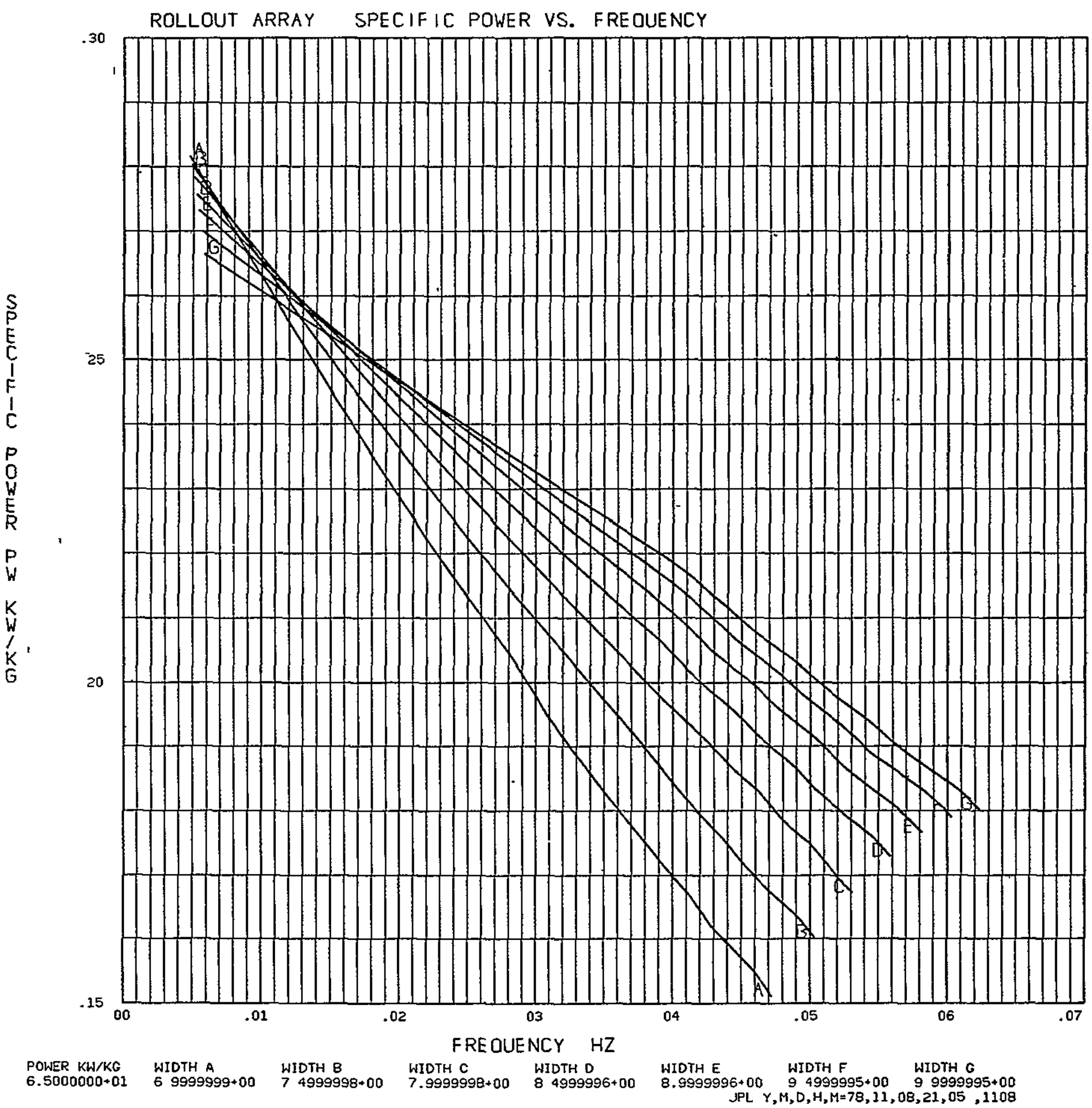


Figure 8(1). Rollout Array Specific Power vs Frequency, 65 kW/wing

C-2

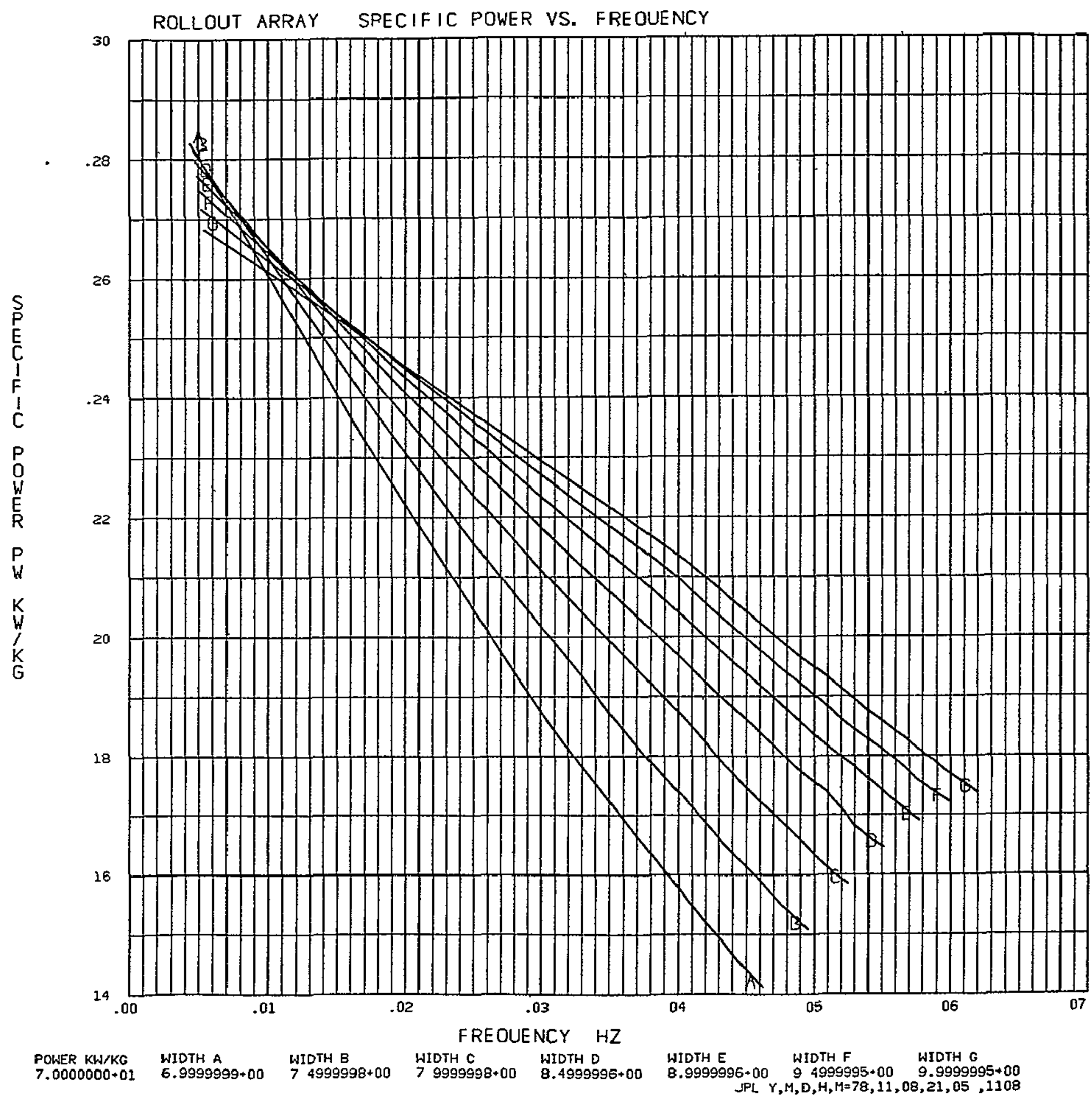


Figure 8(m). Rollout Array Specific Power vs Frequency, 70 kW/wing

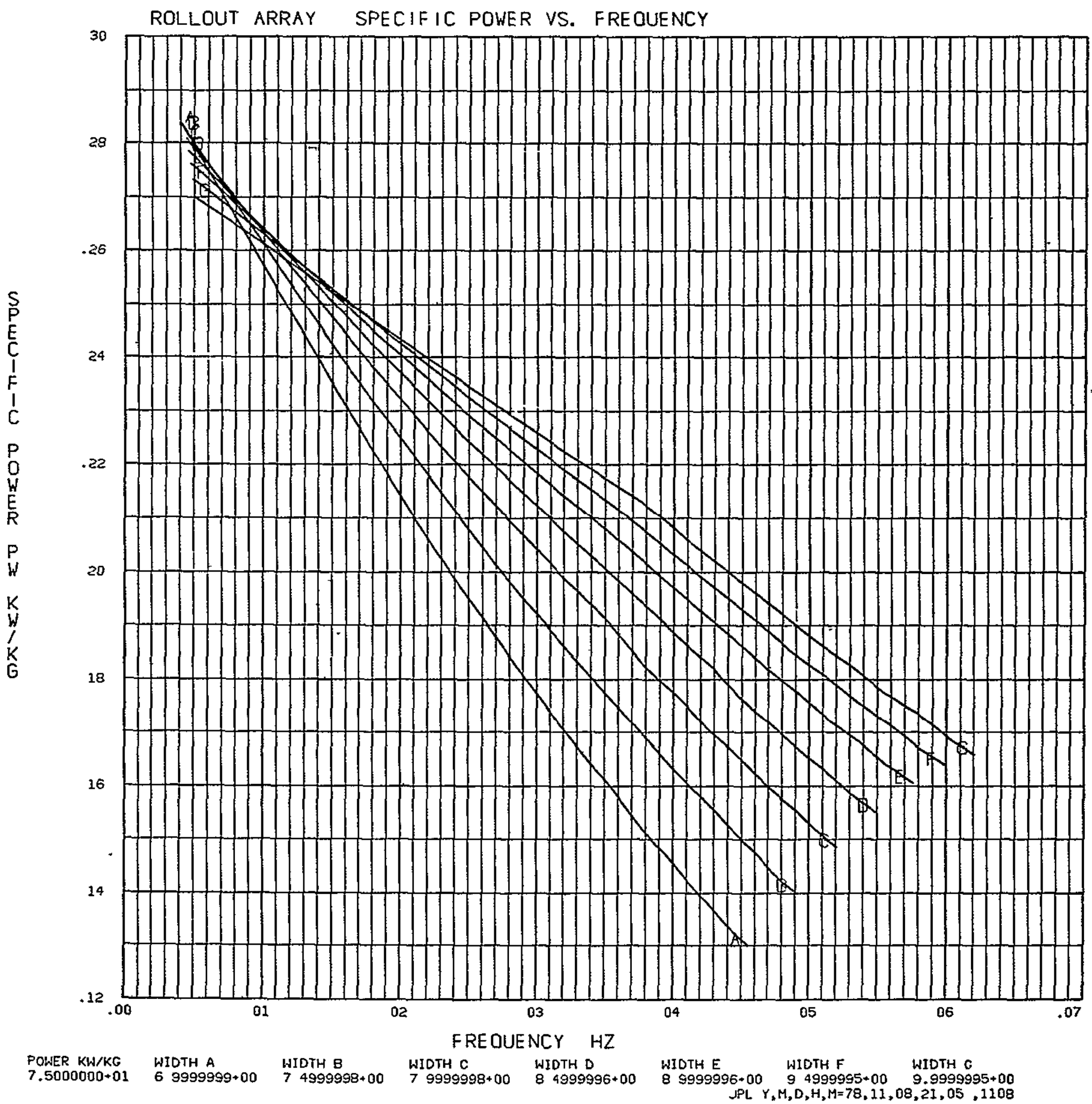


Figure 8(n). Rollout Array Specific Power vs Frequency, 75 kW/wing

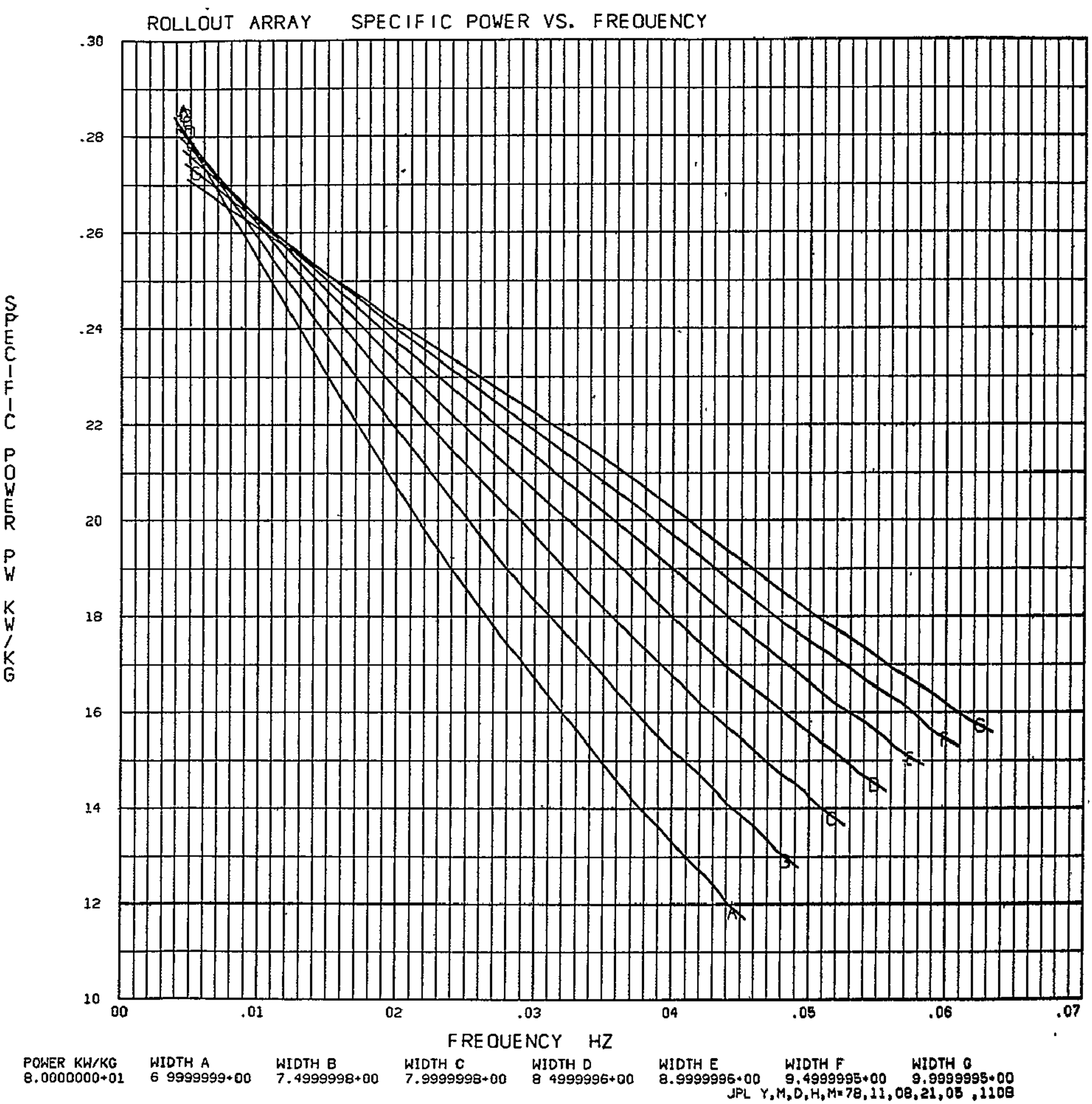


Figure 8(o). Rollout Array Specific Power vs Frequency, 80 kW/wing

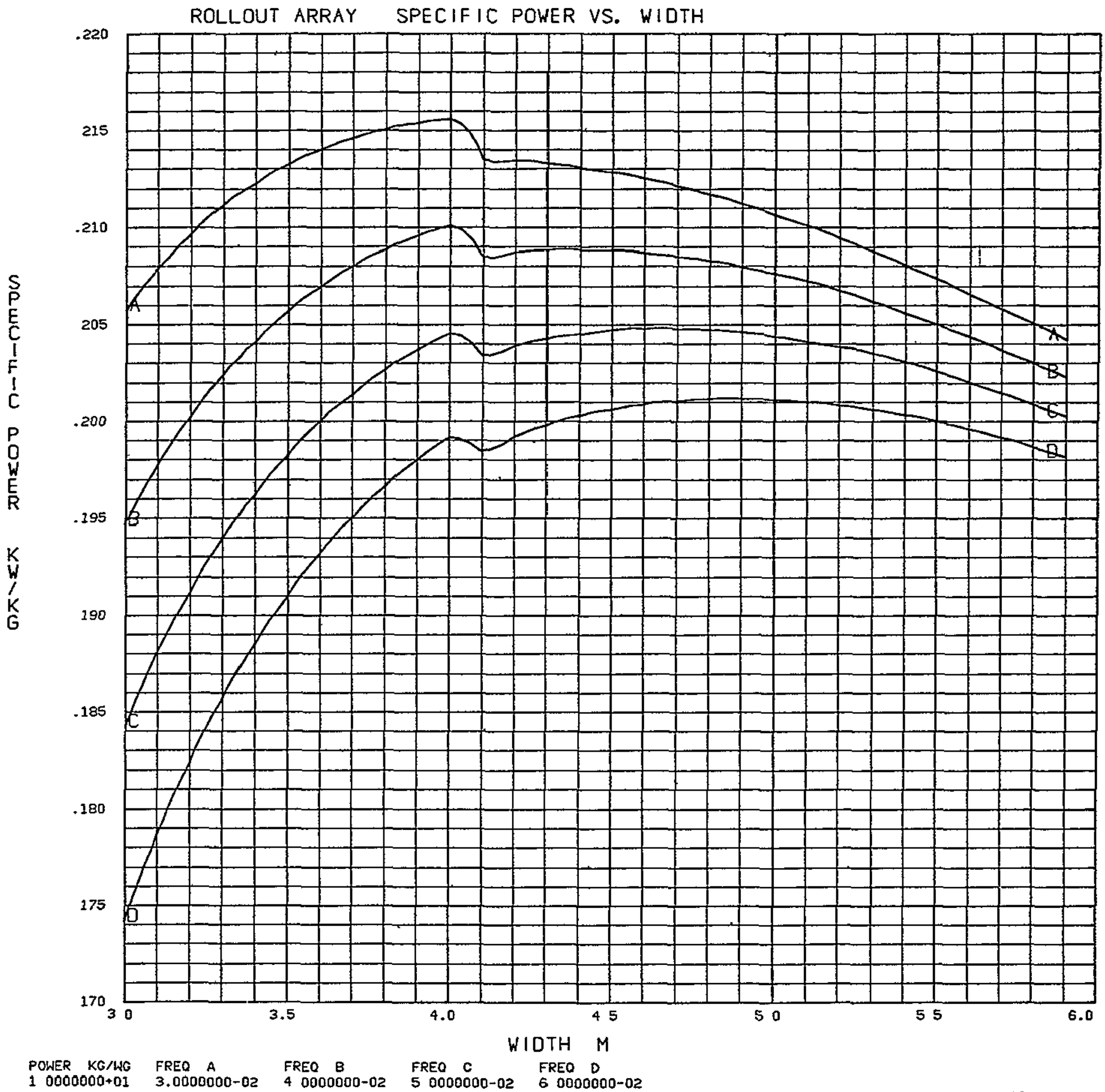


Figure 9(a). Rollout Array Specific Power vs Width, 10 kW/wing

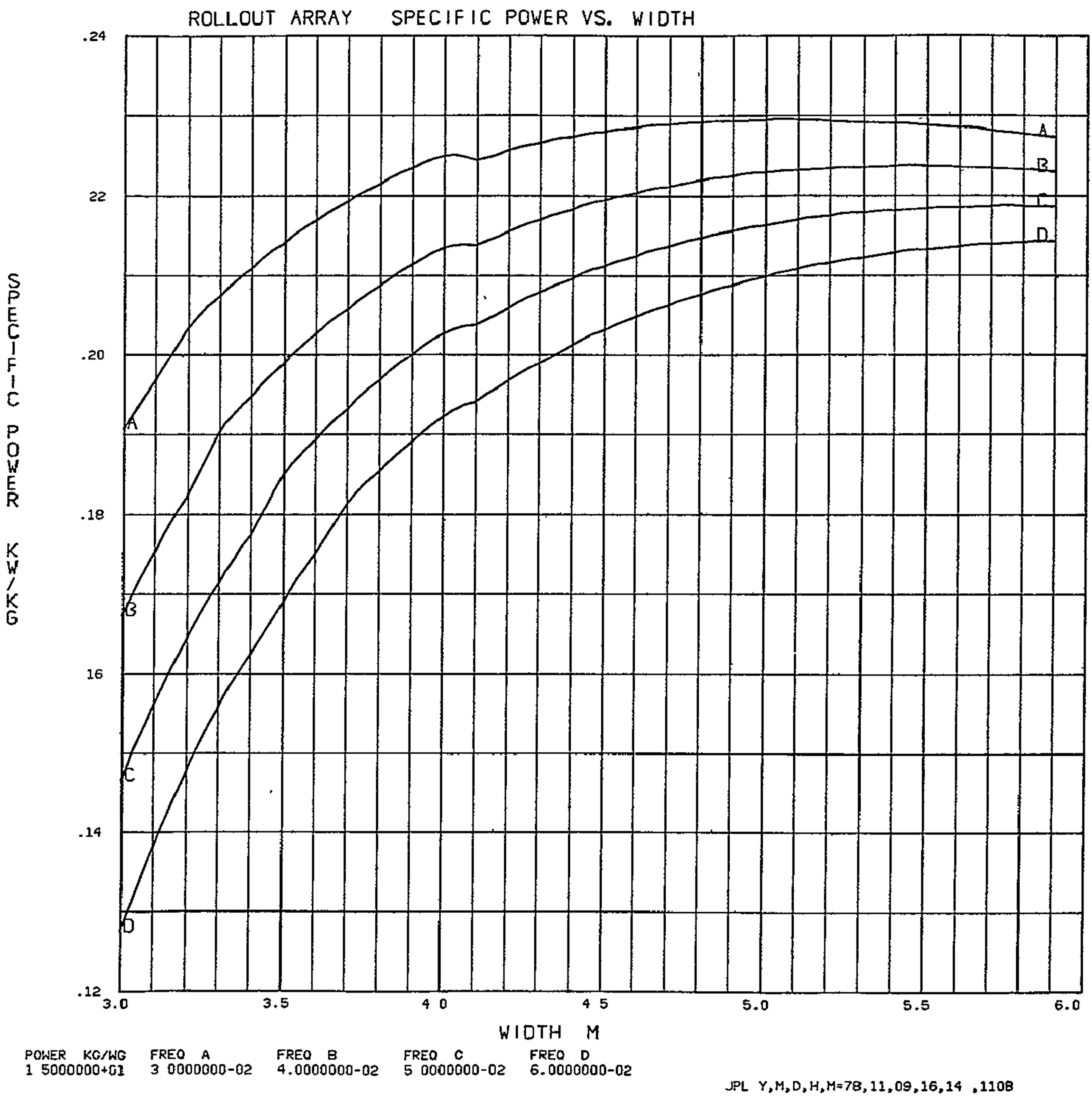


Figure 9(b). Rollout Array Specific Power vs Width, 15 kW/wing

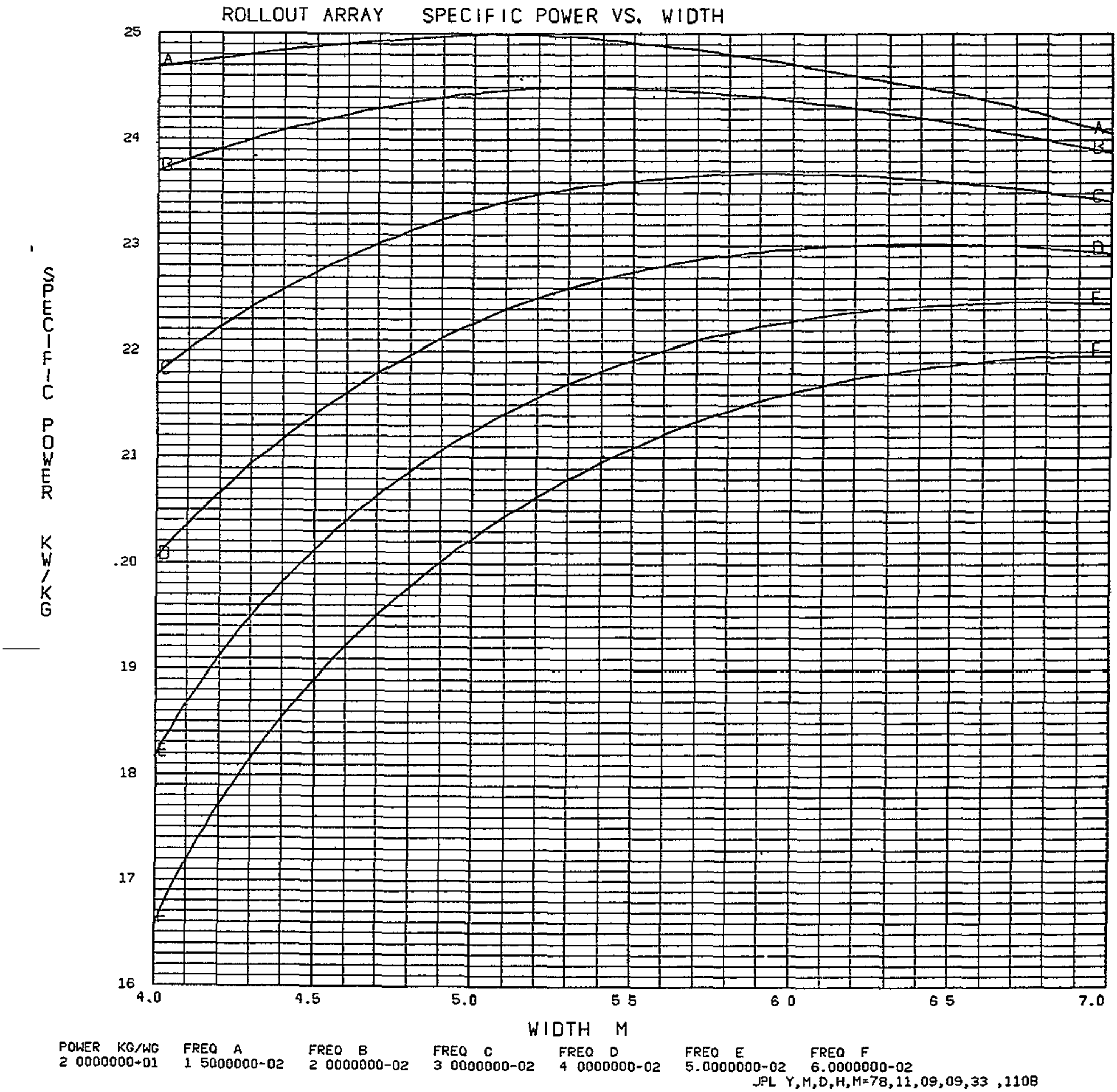


Figure 9(c). Rollout Array Specific Power vs Width, 20 kW/wing

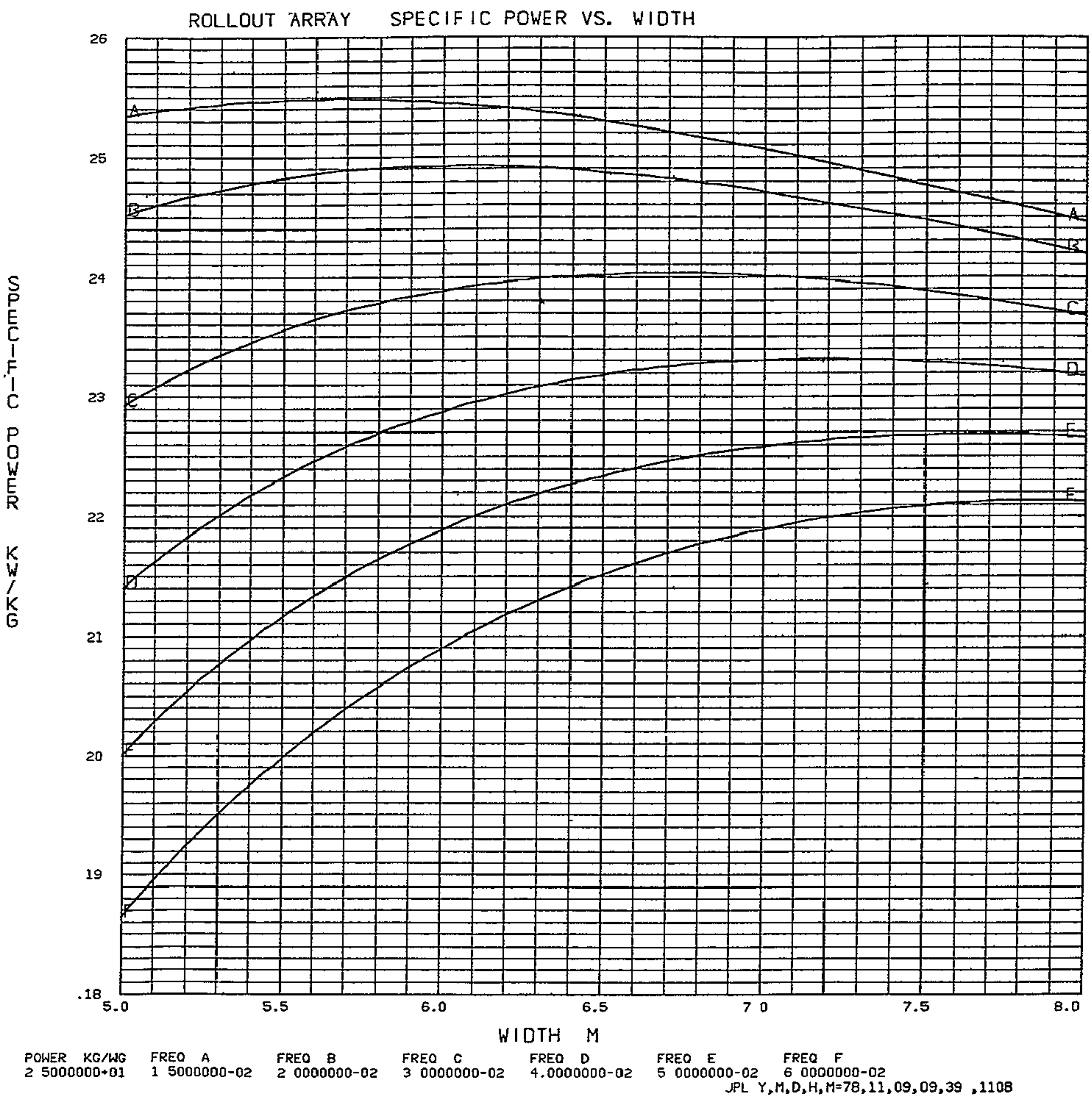


Figure 9(d). Rollout Array Specific Power vs Width, 25 kW/wing

ORIGINAL PAGE IS
OF POOR QUALITY

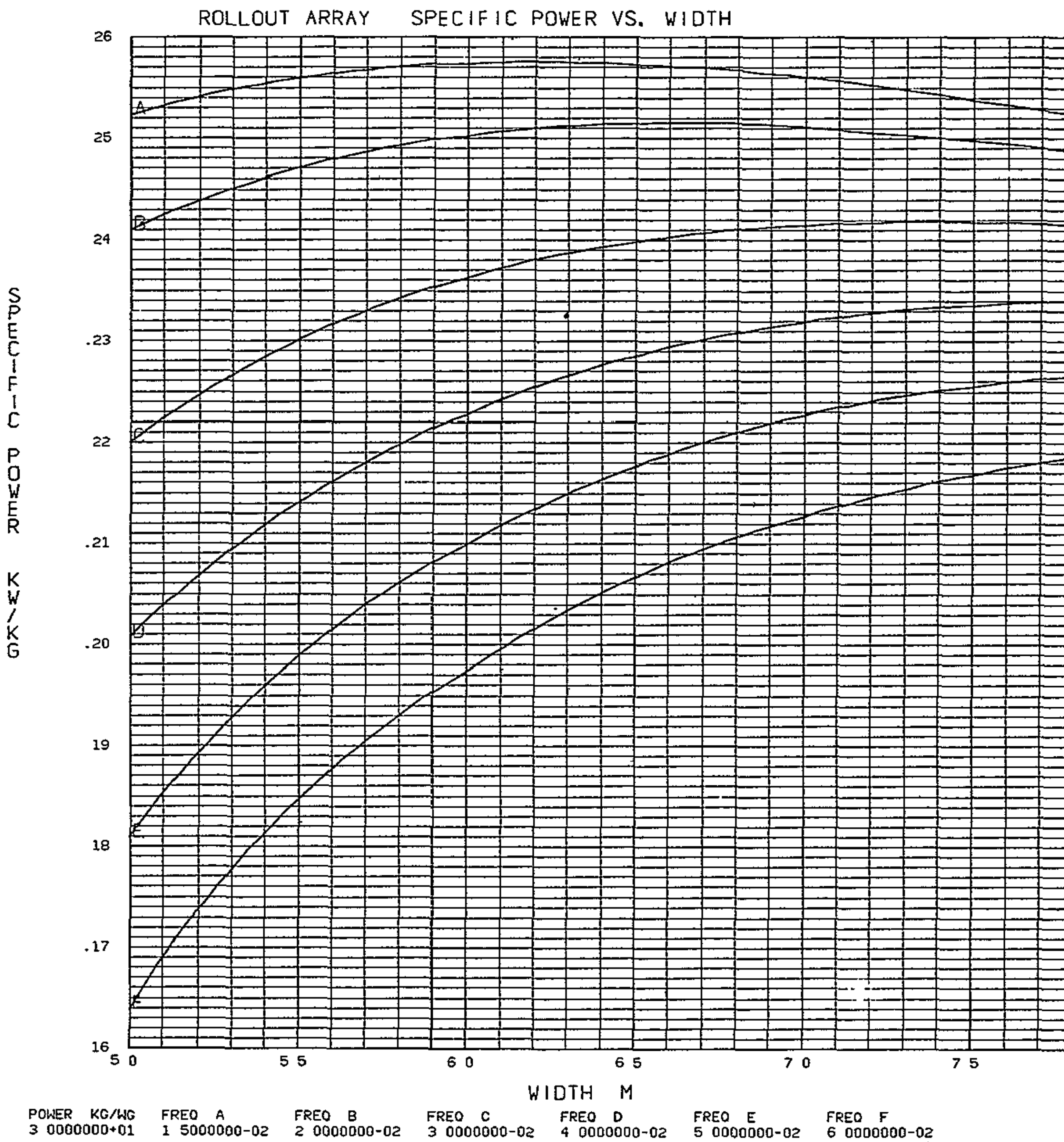


Figure 9(e). Rollout Array Specific Power vs Width, 30 kW/wing

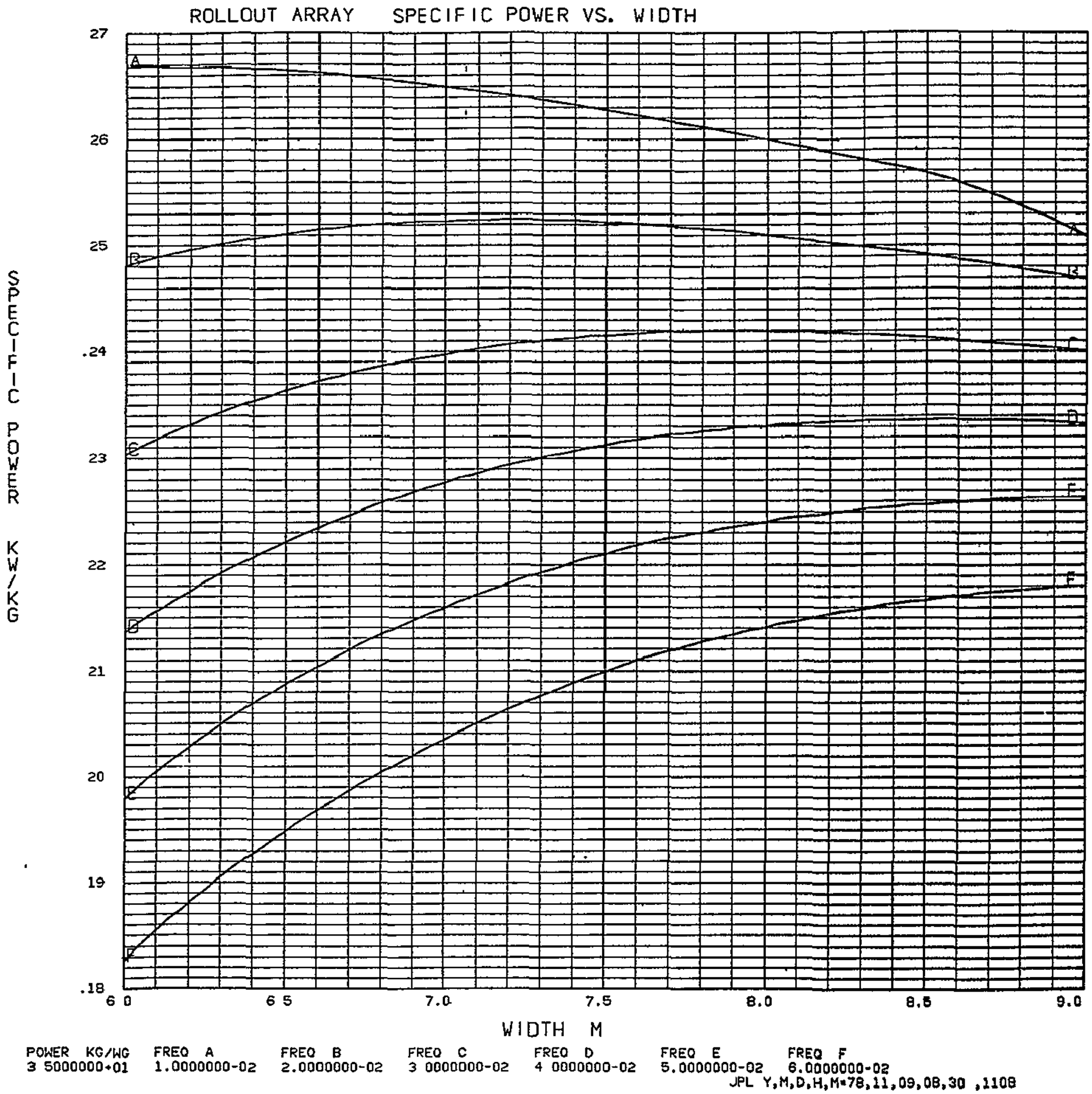


Figure 9(f). Rollout Array Specific Power vs Width, 35 kW/wing

ORIGINAL PAGE IS
OF POOR QUALITY

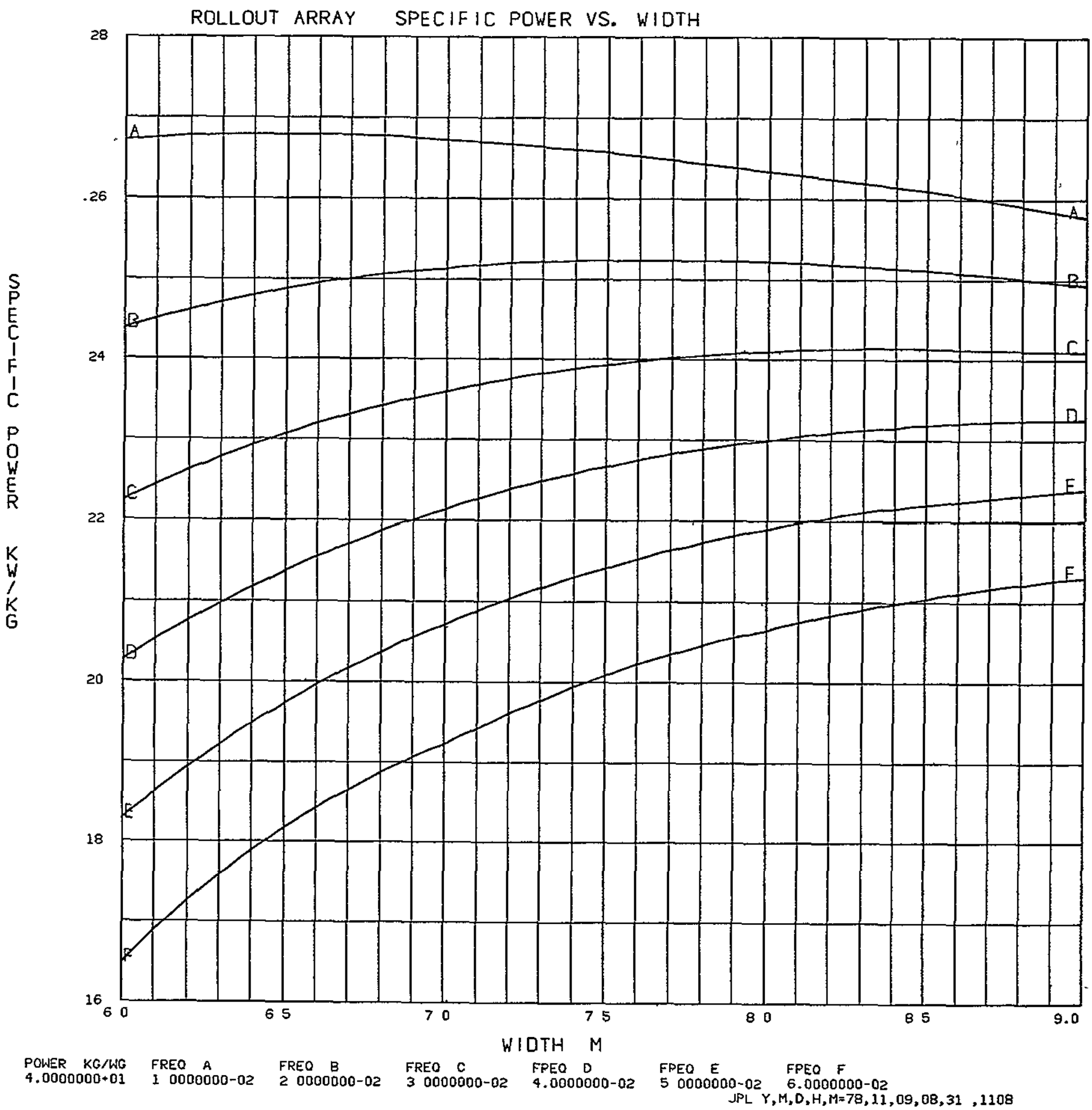


Figure 9(g). Rollout Array Specific Power, vs Width, 40 kW/wing

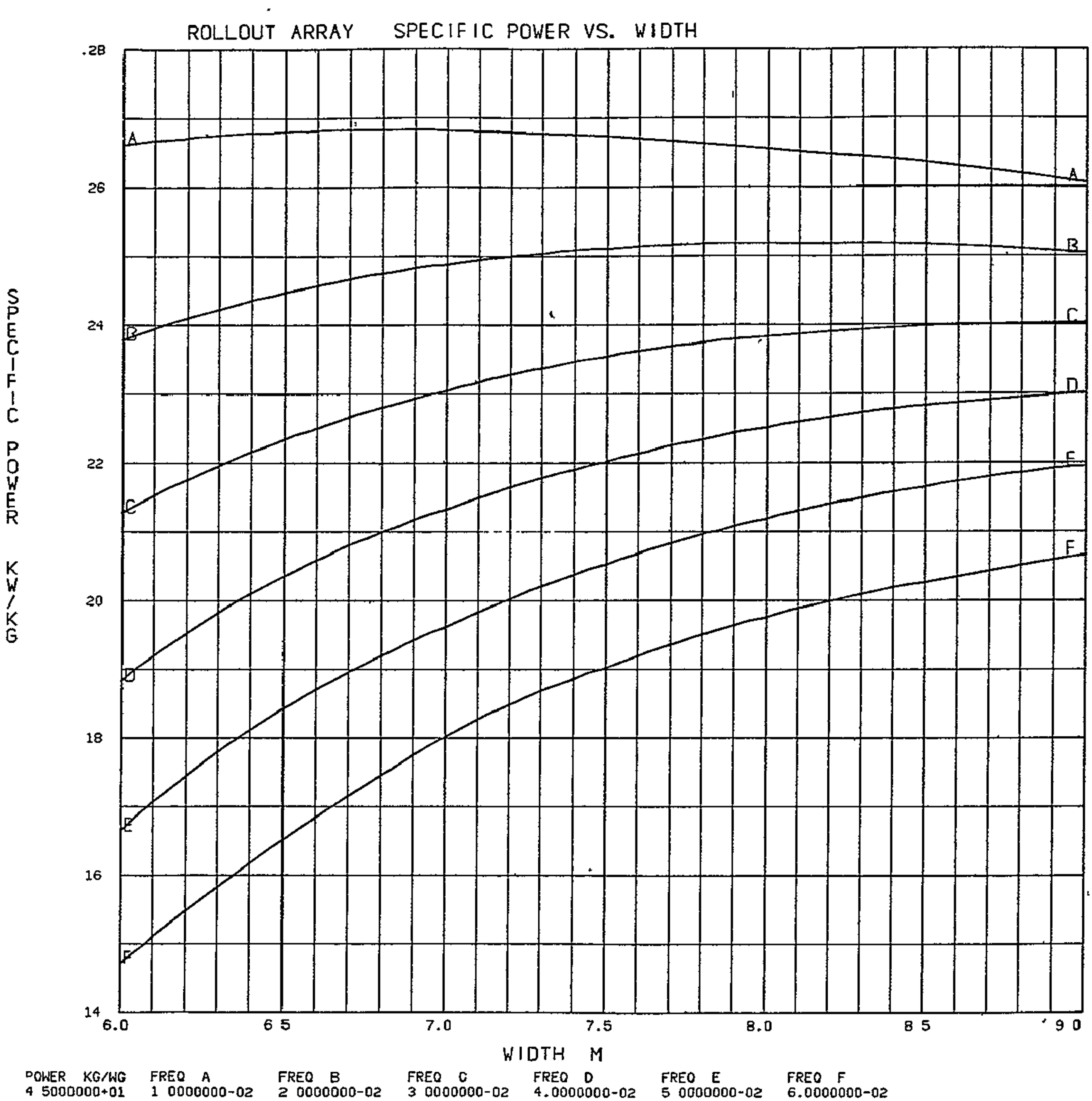


Figure 9(h). Rollout Array Specific Power vs Width, 45 kW/wing

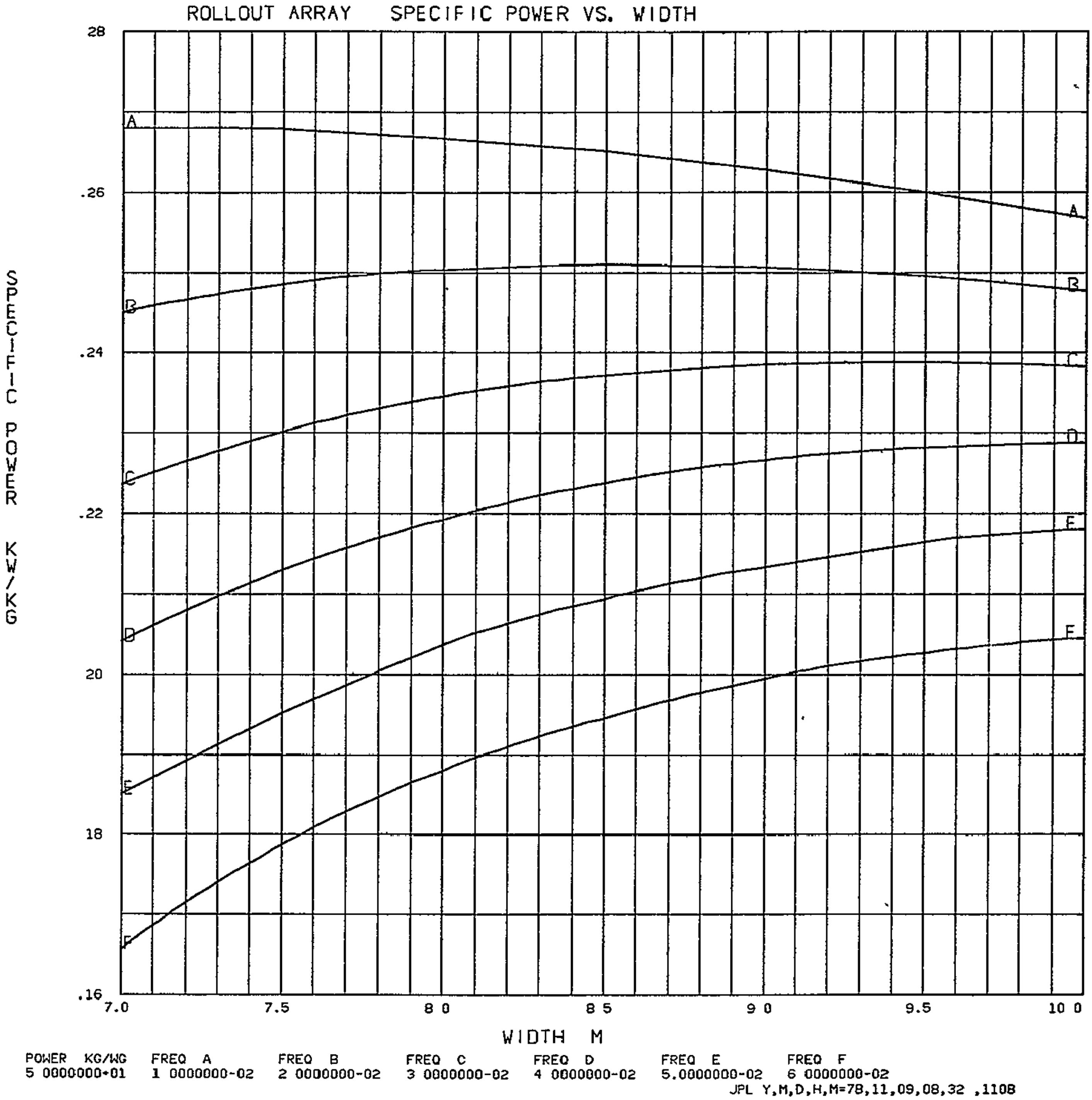


Figure 9(i). Rollout Array Specific Power vs Width, 50 kW/wing

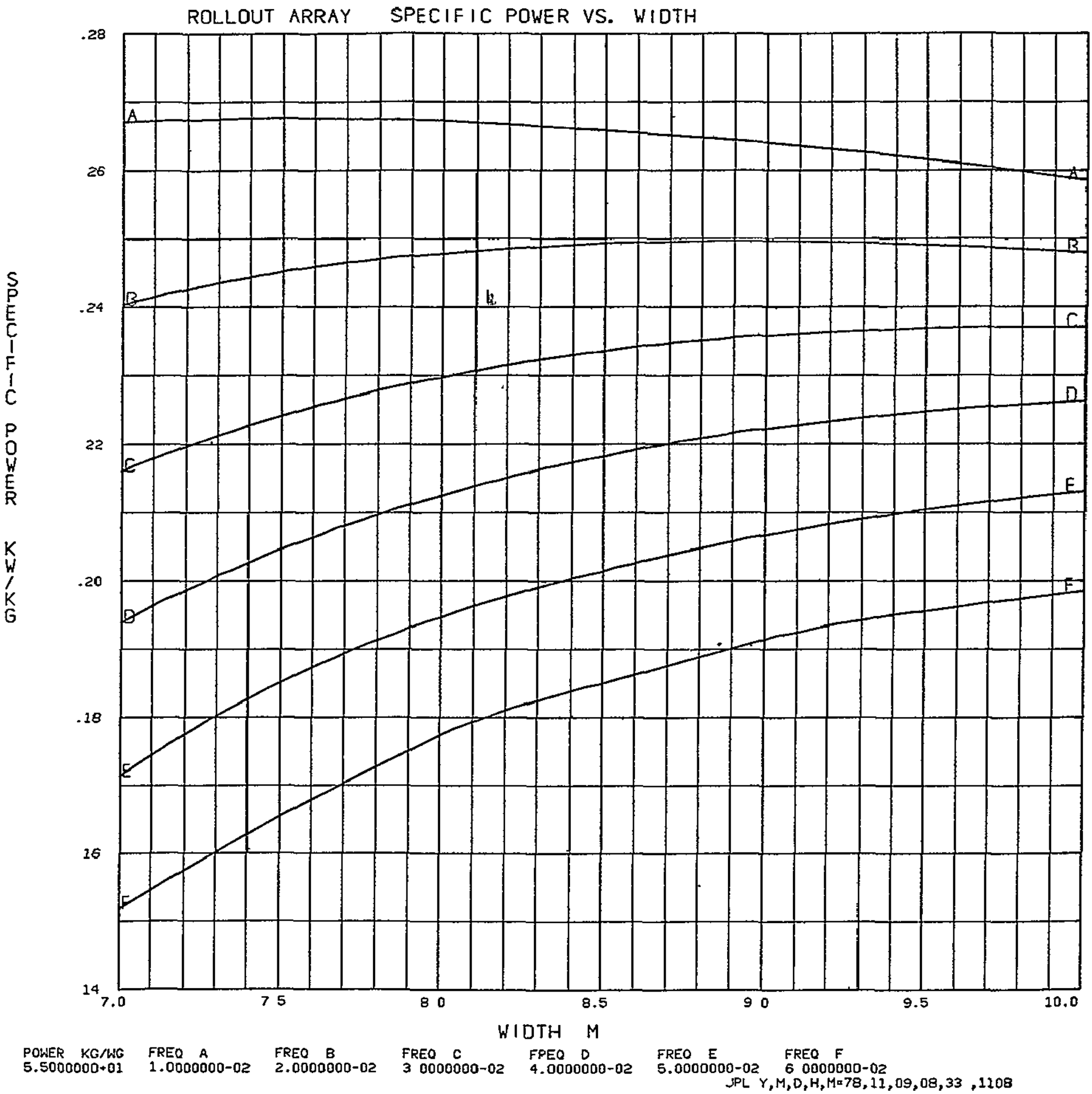


Figure 9(j). Rollout Array Specific Power vs Width, 55 kW/wing

ORIGINAL PAGE IS
OF POOR QUALITY

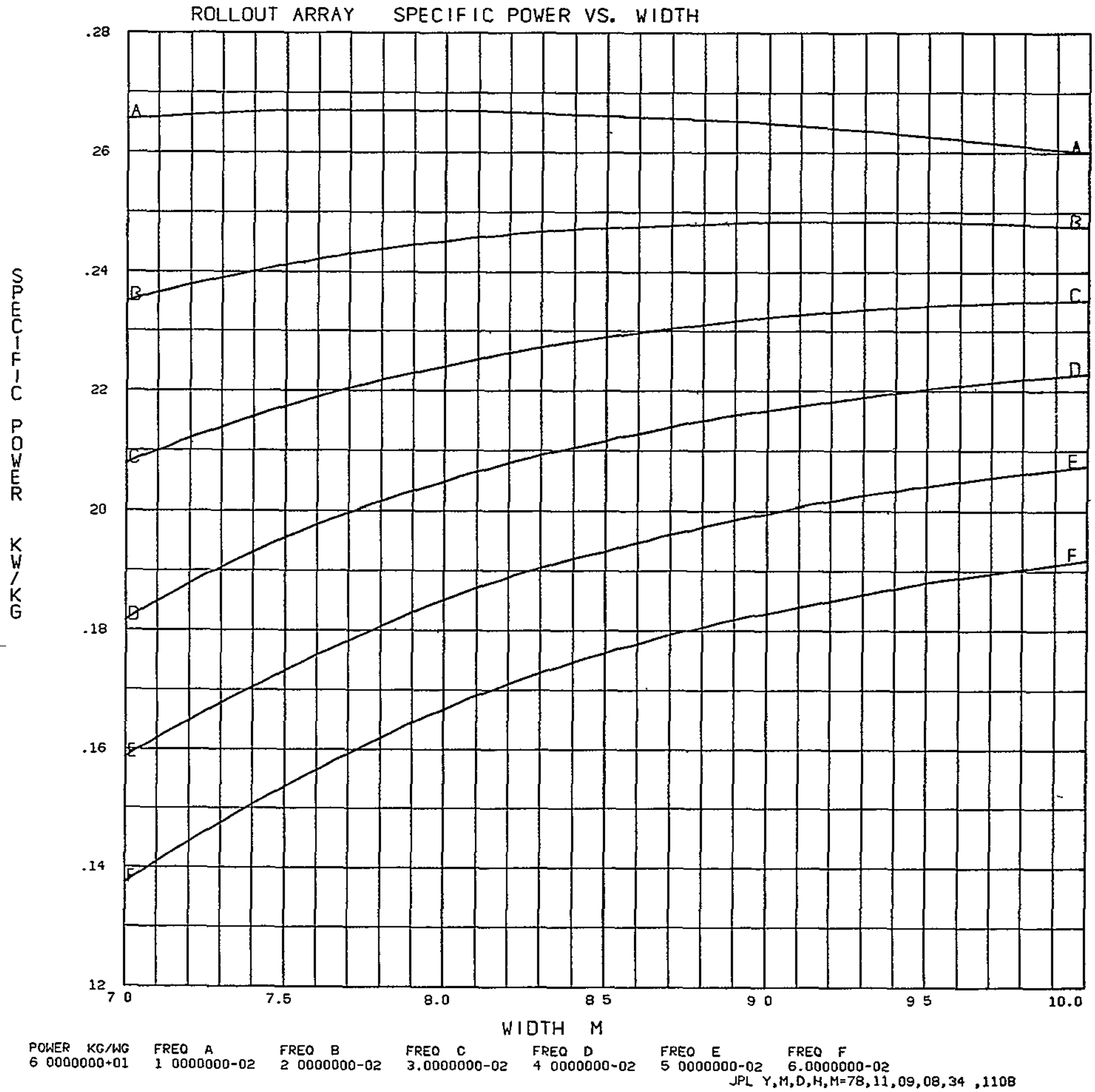


Figure 9(k). Rollout Array Specific Power vs Width, 60 kW/wing

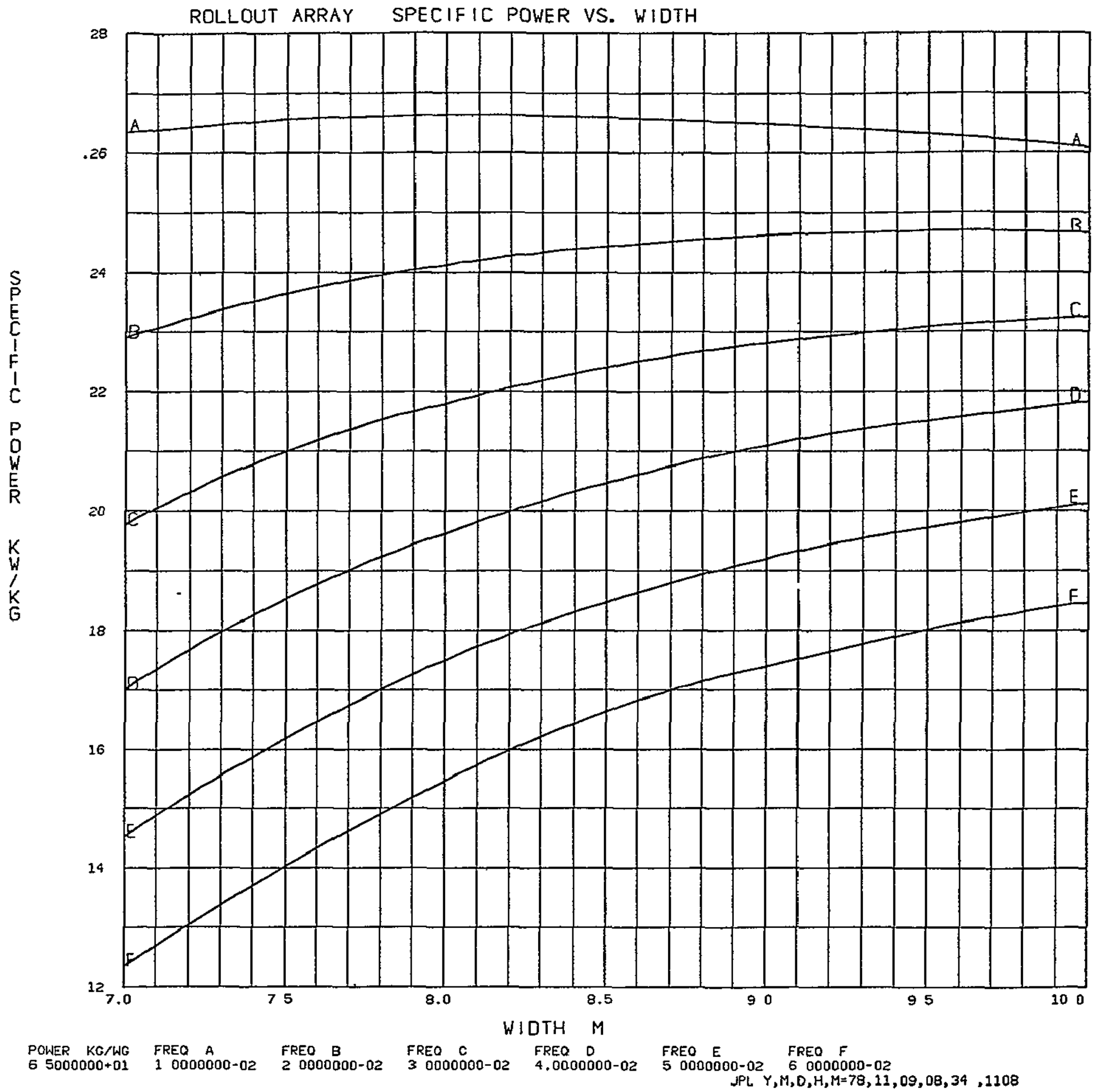


Figure 9(1). Rollout Array Specific Power vs Width, 65 kW/wing

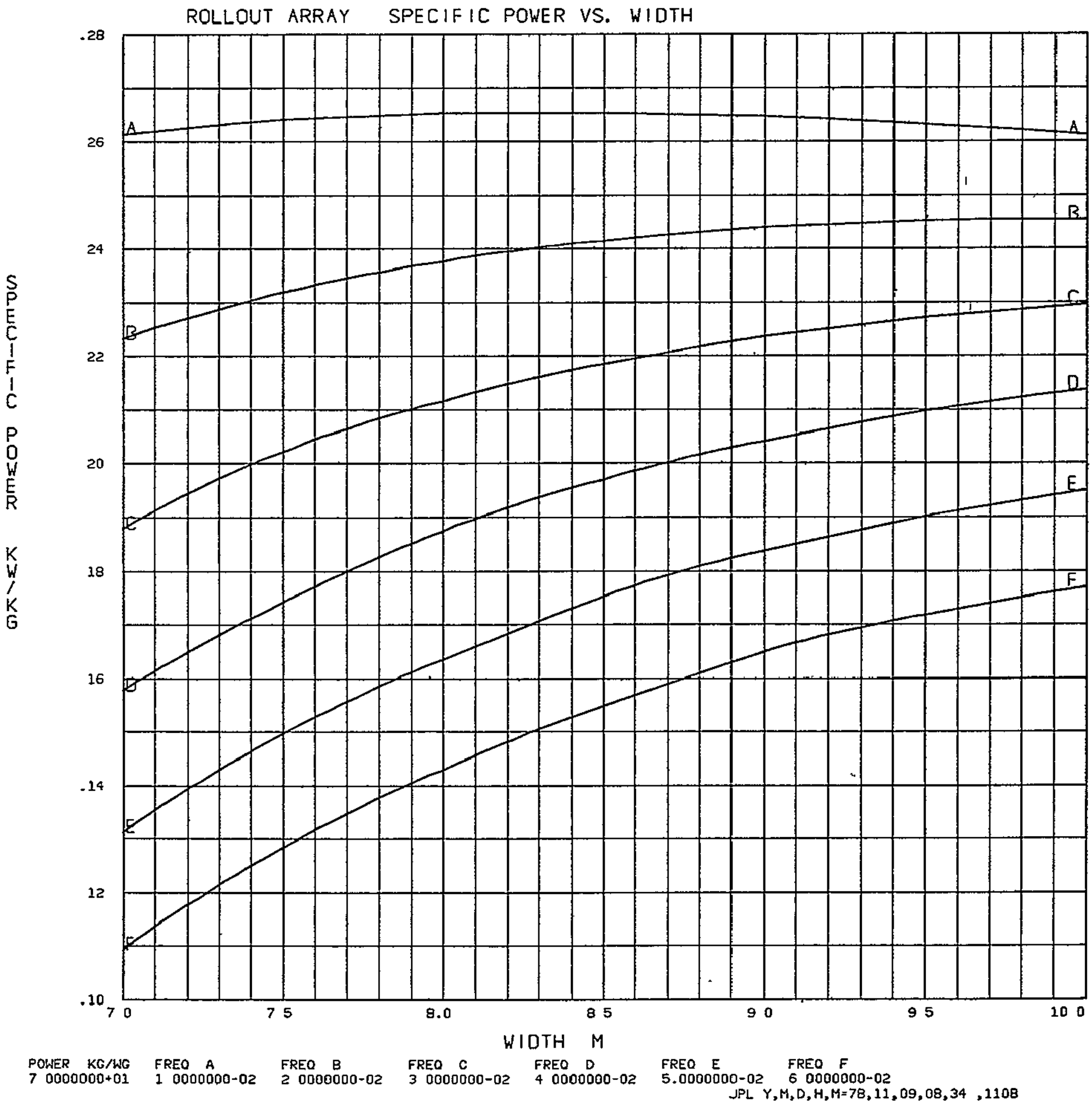


Figure 9(m). Rollout Array Specific Power vs Width, 70 kW/wing

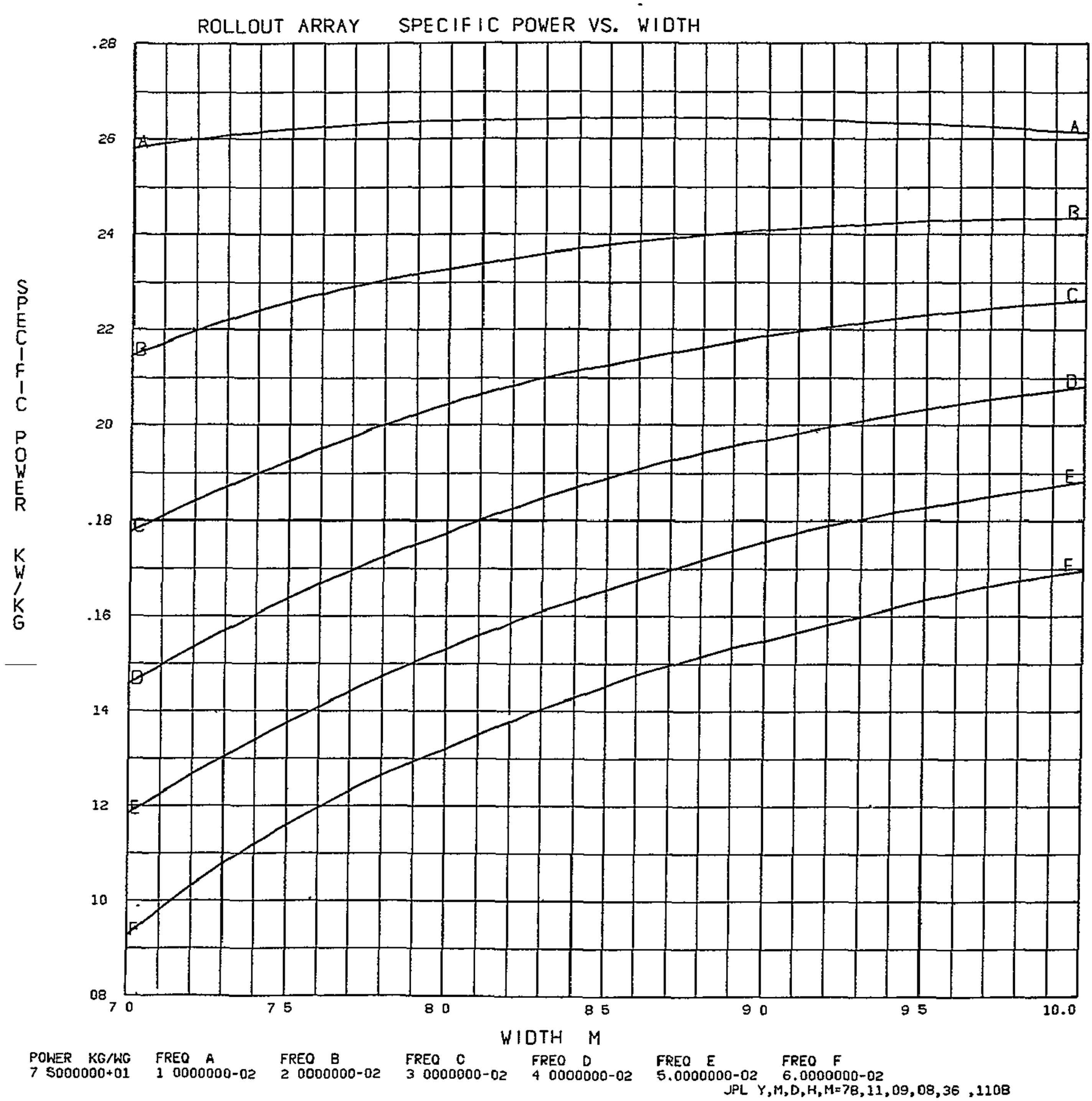


Figure 9(n). Rollout Array Specific Power vs Width, 75 kW/wing

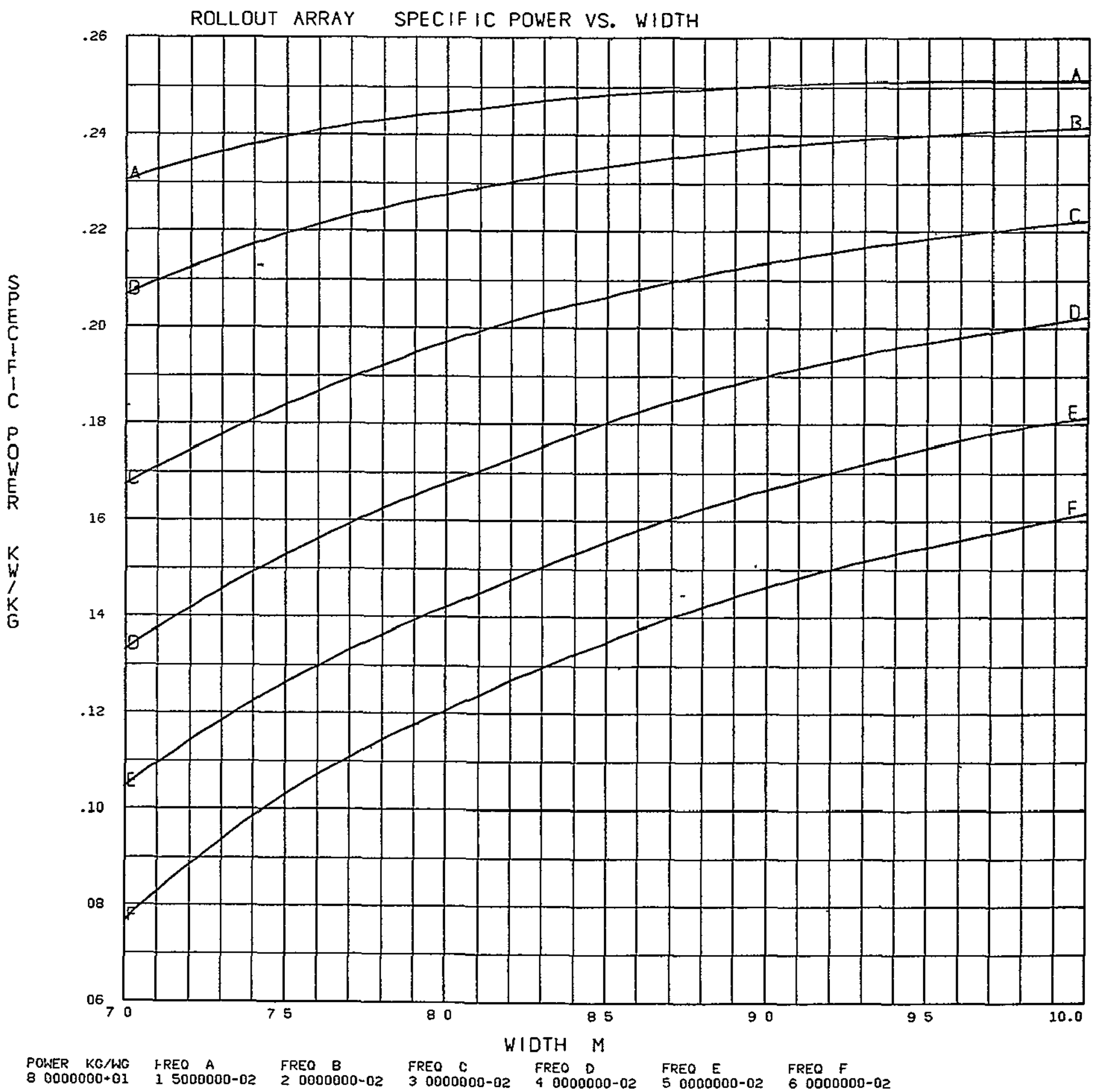


Figure 9(o). Rollout Array Specific Power vs Width, 80 kW/wing

APPENDIX A

WEIGHT SUMMARY FOR THE BASELINE CONCEPTUAL DESIGN CONFIGURATION

CONTENTS

APPENDIX A

WEIGHT SUMMARY FOR THE BASELINE CONCEPTUAL DESIGN CONFIGURATIONS

The Appendix contains the basic weight data used in the study. It is divided into two sections. Section I contains the original array weights as reported by the conceptual design contractors. The weight as adjusted to account for the modifications is summarized in Section II.

I. ORIGINAL ARRAY WEIGHTS

1. FOLDOUT ARRAY

The original weight summary for the foldout array is shown in Tables A-I through A-III for the 12.5, 30, and 60 kW/wing configuration, respectively. These tables are taken directly from References 12 and 13. Table A-I represents a much more detailed weight breakdown than either Table A-II or Table A-III. This reflects the depth to which the conceptual design studies were conducted. The 12.5 kW/wing foldout configuration was studied in much more detail than the other two.

Also note that contingencies are included in Table A-I, where the other two configurations contain no contingencies.

2. ROLLOUT ARRAY

The original weight summary for the rollout array is given in Tables A-IV and A-V for the 10 kW/wing and 60 kW/wing configuration, respectively. These tables are taken directly from References 14 and 15.

TABLE A-I - SEP SOLAR ARRAY WEIGHT SUMMARY - 12.5 kW/wing

ITEM NO.	COMPONENT TREE	ESTIMATED WEIGHT (KG)	CONT. FACTOR	WEIGHT WITH CONTINGENCY FACTOR (KG)	NO. PER MODULE	WEIGHT/ MODULE (KG)
	Required Module Weight				1	190.00
	Design Weight	184.11			1	189.71
1.0	Mast	32.04	.15	36.85	1	36.85
1.1	Canister	16.31				
1.2	Mast Element	15.73				
2.0	Guide Wire Mechanism	.725	.15	.83	2	1.66
2.1	Wire (31.6 M) (1)	.001				
2.2	Negator (2)	.455				
2.3	Wire Reel (1)	.111				
2.4	Negator Hub (1)	.066				
2.5	Negator Reel (2)	.053				
2.6	Shaft (3)	.026				
2.7	Washers	.007				
2.8	Panel/Wire Retainer (42)	.006				
3.0	Intermediate Tension Mechanism	1.50	.15	1.725	2	3.45
3.1	Wire (21.7 M)	.001				
3.2	Negator (2)	1.132				
3.3	Wire Reel (1)	.081				
3.4	Negator Hub (1)	.139				
3.5	Negator Reel (2)	.103				
3.6	Shaft (3)	.038				
3.7	Washers	.006				
4.0	Full Tension Mechanism	.325	.15	.37	2	.74
4.1	Wire (1 M)	.001				
4.2	Negator (4)	.139				
4.3	Wire Reel (1)	.013				
4.4	Negator Hub (1)	.045				
4.5	Negator Reel (4)	.074				
4.6	Shaft (5)	.048				
4.7	Washers	.005				

EXTENSION/RETRACTION ASSEMBLY

TABLE A-I (CONT'D) - 12.5 kW/wing

ITEM NO.	COMPONENT TREE	ESTIMATED WEIGHT (KG)	CONT. FACTOR	WEIGHT WITH CONTINGENCY FACTOR (KG)	NO. PER MODULE	WEIGHT/ MODULE (KG)
5.0	Tension Transfer	.018	.20	.02	1	.02
5.1	Pulleys (6)	.003				
5.2	Brackets (6)	.012				
5.3	Pins (6)	.003				
6.0	Mast Tip Fitting	.73	.15	.84	1	.84
6.1	Support (1)	.35				
6.2	Brace (2)	.38				
7.0	Cover Assembly	7.45	.15	8.57	1	8.57
7.1	Honeycomb Panel (1)	5.60				
7.1.1	Skin (2)	1.98				
7.1.2	Core (1)	.62				
7.1.3	Sides	.23				
7.1.4	Adhesive	.47				
7.2	Preload Distribution Structure (2)	2.36				
7.3	Load Transfer Swint Links (4)	.08				
7.4	Preload Lever Arm (4)	1.29				
7.4.1	Tube (1)	.15				
7.4.2	Fittings (2)	.17				
7.5	Pivot Pins (12)	.04				
7.6	Toggle Assy. (4)	.105				
7.6.1	Outer Link	.006				
7.6.2	Inner Link	.004				
7.6.3	Clevis	.002				
7.6.4	Spring	.001				
7.6.5	Pin	.012				
7.7	Pad (1)	.13				
7.8	Adhesive	.21				

EXTENSION/RETRACTION ASSEMBLY

STORAGE ASSEMBLY

TABLE A-I (CONT'D) - 12.5 kW/wing

STORAGE ASSEMBLY

ITEM NO.	COMPONENT TREE	ESTIMATED WEIGHT (KG)	CONT. FACTOR	WEIGHT WITH CONTINGENCY FACTOR (KG)	NO. PER MODULE	WEIGHT/ MODULE (KG)
8.0	Container	10.10	.15	11.62	1	11.62
	Honeycomb Panel (1)	3.26				
8.1	Skin (2)	1.80				
8.2	Core (1)	.63				
8.3	Edging	.44				
8.4	Inserts	.45				
	Adhesive	.44				
9.0	Triangular Beam	6.34				
9.1	Skin (2)	2.66				
9.2	Bulkhead (2)	.33				
9.3	Longeron (3)	1,00				
9.4	Support Fitting (4)	.41				
9.4.1	Fitting (4)	.30				
9.4.2	Roller (4)	.05				
9.4.3	Pin (4)	.06				
9.5	Perimeter Shield (1)	1.13				
9.6	Pad (1)	.35				
9.7	Adhesive	.46				
10.0	Support Struts	1.21	.15	1.39	1	1.39
10.1	Long (2)	.50				
10.2	Medium (2)	.41				
10.3	Short (2)	.16				

TABLE A-I (CONT'D) - 12.5 kW/wing

BLANKET ASSEMBLY

ITEM NO.	COMPONENT TREE	ESTIMATED WEIGHT (KG)	CONT. FACTOR	WEIGHT WITH CONTINGENCY FACTOR (KG)	NO. PER MODULE	WEIGHT/ MODULE (KG)
11.0	Solar Cell Blanket	113.18	.04	117.71		117.71
11.1	Upper Leader	.14				
11.2	Upper Attach Bar	.16				
11.3	Bottom Tension Dist. Bar	.65				
11.4	Intermediate Tension Dist. Bar	.26				
11.5	Lower Leader	.17				
11.6	Panel (4)	112.270				
11.6.1	Substrate W/Pad - W/Stiffening	.531				
11.6.2	Solar Cells (3060)	1.171				
11.6.3	Cover Adhesive (3060)	.130				
11.6.4	Coverslide (3060)	.845				
11.6.5	Hinge (2)	.058				
11.6.6	Hinge Pin (1)	.003				
	Total	2.738				
12.0	Interconnect Harness	5.59	.05	5.87	1	5.87
	FCC Power	5.22				
	FCC (Instrumentation)	.25				
	Receptacles (4)	.12				
13.0	Misc. Nuts & Bolts	.90	.10	.99	1	.99

TABLE A-II

30 kW/wing PLANAR SOLAR ARRAY WEIGHT SUMMARY, 200 W/kg

Component	Weight (kg)	No. Req'd/Wing	Wing Weight (kg)
Blanket Assembly	44.90	2	89.8
Panels (40)	36.15		
Hinges (40)	1.7		
Tension Distribution (1)	0.45		
Leader	0.6		
Harness	6.0		
Blanket Tension & Control	3.4	2	6.8
Cover	3.02	2	6.0
Container	5.78	2	11.6
Blanket Padding	0.03	78	2.34
Mast	23.6	1	23.6
Tip Fitting	0.7	1	0.7
Wing Position Boom	9.0	1	9.0
		Total Wing Weight	149.84 kg
		Total Array Weight	299.7 kg

TABLE A-III
60 kW/wing PLANAR SOLAR ARRAY WEIGHT SUMMARY, 200 W/kg

Component	Weight (kg)	No. Req'd/Wing	Wing Weight (kg)
Blanket Assembly	70.00	2.5	175.0
Panels (64)	58.23		
Hinges (64)	2.72		
Tension Distribution (1)	0.45		
Leader	0.6		
Harness	8.0		
Blanket Tension & Control	4.0	2.5	10.0
Cover	4.4	2.5	11.0
Container	9.24	2.5	23.12
Blanket Padding	0.03	158.0	4.74
Mast	60.0	1	60.0
Tip Fitting	1.0	1	1.0
Position Links	2.5	2	5.0
Wing Position Boom	10.0	1	10.0
		Total Wing Weight	299.86
		Total Array Weight	599.72

TABLE A-IV ROLLOUT 10 kW/wing WEIGHT SUMMARY

Subsystem	Item No.	Item	Unit Weight (kg)	Quantity per 10 kW	Total Weight (kg)	
					Rollout	Foldout
Electrical	1	Solar Cell	94×10^{-6}	160,000	15.04	15.04
	2	Substrate	1.4	2	2.80	2.80
	3	Adhesive	1.08	2	2.16	2.16
	4	Cover Material	2.97	2	5.94	5.94
	5	Interconnects	.87	2	1.72	1.72
	6	Bus Strips	.17	2	.34	.34
	7	Slip Ring Assembly	1.43	2	2.86	–
	8	Cable	.15	2	.06	.06
				Subtotal	31.22	28.36
Mechanical	10	Drum	2.95	2	5.9	–
	11	Shaft	.22	2	.44	–
	12	Bearings	.10	6	.60	–
	13	Container, Blanket	3.48	2	–	6.36
	14	Truss	.51	2	–	1.03
	15	Center Support	2.23	1	2.23	2.07
	16	Pad and Valve	.82	2	–	1.64
				Subtotal	9.17	11.10
Array Structure	17	Boom	.91	1	1.07	1.07
	18	Header	.90	1	.77	.77
	19	Leading Edge (LEM)	1.06	2	2.12	2.12
	20	End Strip	.05	4	.20	.20
	21	Misc. Hardware	–	–	.50	.50
				Subtotal	4.66	4.66
Actuators	22	Boom Deployer	3.18	1	3.18	3.18
	23	Tension Motor	.60	2	1.20	–
	24	Tension Spring	.24	1	.24	.24
		Net Weight			49.67	47.54
		5% Tolerance & Contingency			2.48	2.38
		Total Weight Estimate			52.15	49.92
		Specific Power (Watts/kg)(BOL)			201.3	210.3

TABLE A-V. ROLLOUT 60 kW/wing WEIGHT SUMMARY

ITEM	UNIT MASS (KG)	QUANTITY PER WING	TOTAL PER WING (KG)
ELECTRICAL			
SOLAR CELLS	78×10^{-6}	985,344	76.86
SUBSTRATE	8.71	2	17.42
ADHESIVE	6.61	2	13.21
COVER MATERIAL (1 MIL)	11.09	2	22.17
INTERCONNECTS	4.82	2	9.65
BUS STRIPS	2.19	2	4.39
SLIP RING ASSY	2.26	2	4.52
CABLES	0.2	2	0.40
CONNECTORS	0.04	6	0.24
RELAYS	0.03	24	0.72
CONTROLS MODULES	0.20	2	0.40
SUBTOTAL			149.98
MECHANICAL			
DRUMS	5.25	2	10.50
SHAFT ASSY	3.22	2	6.44
BEARINGS	0.15	6	0.90
CENTER SUPPORT	8.92	1	8.92
TENSION MOTORS	11.76	2	23.52
MAST DEPLOYER	31.00	1	31.00
SUBTOTAL			81.28
ARRAY STRUCTURE			
MAST	36.40	1	36.40
LEADING EDGE MEMBER	0.98	2	1.96
HEADER	1.98	1	1.98
SUBTOTAL			40.34

TOTAL WEIGHT PER WING = 271.6 kg

SPECIFIC POWER = 223.5 WATTS/kg

MASS CONTINGENCY (15%) = 40.7 kg

SPECIFIC POWER (WITH CONTIN.) = 194.5 WATTS/kg

II. MODIFIED ARRAY WEIGHTS

1. FOLDOUT ARRAY

The weights for the foldout array have been adjusted to account for the minor modifications in the conceptual designs made by JPL. These weights for the three power levels are shown in Tables A-VI through A-VIII. These data contain no contingencies.

2. ROLLOUT ARRAY

Tables A-IX and A-X contain the weight breakdown for the rollout configuration as modified by JPL.

TABLE A-VI
WEIGHT BREAKDOWN FOR THE FOLDOUT UNBROKEN ARRAY
12.5 kw/Wing Array

	Weight, kg
Blanket	113.18
Container	10.1
Support Truss	1.21
Interconnect Harness	5.59
Box Cover	4.5
Cover Latch	0.90
Mast Tip Fitting	0.73
Tension Transfer Mechanism	0.02
Full Tension Mechanism	.64
Intermediate Tension Mechanism	3.0
Guide Wire Tension Mechanism	1.48
Mast	15.73
Mast Canister	16.31
Miscellaneous Hardware	0.9
TOTAL	174.29

TABLE A-VII
WEIGHT BREAKDOWN FOR THE FOLDOUT UNBROKEN ARRAY
30 kw/Wing Array

	Weight, kg
Blanket	226.17
Container	20.20
Support Struts	1.63
Interconnect Harness	11.18
Box Cover	9.01
Cover Latch	1.79
Mast Tip Fitting	0.87
Tension Transfer Mechanism	.04
Full Tension Mechanism	.75
Intermediate Tension Mechanism	1.48
Guide Wire Tension Mechanism	.50
Mast	5.0
Mast Canister	4.7
Miscellaneous Hardware	.9
TOTAL	284.22

TABLE A-VIII

WEIGHT BREAKDOWN FOR THE FOLDOUT BROKEN ARRAY

60 kw/Wing Array

	Weight, kg
Blanket	454.66
Container	40.96
Support Struts	2.48
Interconnect Harness	22.36
Box Cover	18.15
Cover Latch	2.41
Box Hinges & Latches	2.56
Post Deploy Cover Latch	.14
Mast Tip Fitting	1.35
Tension Transfer Mechanism	.05
Full Tension Mechanism	.95
Intermediate Tension Mechanism	.68
Guide Wire Tension Mechanism	5.12
Box Deployment Device	.005 Torque (in lbs.)
Mast	20.6
Mast Canister	12.1
TOTAL	584.57 + .005T

TABLE A-IX

WEIGHT BREAKDOWN

for the

Rollout 10 kw/Wing Array

	Weight, kg
Blanket	28.00
Slip Ring Assembly	2.85
Cable	0.06
Drum	5.90
Shaft	0.44
Bearings	0.60
Center Support	2.23
Mast	1.07
Header	0.77
Leading Edge	2.12
End Strip	0.20
Misc. Hardware	0.50
Mast Canister	3.18
Tension Motor	1.50
Mast Sleeve	.41
TOTAL	49.83

TABLE A-X

WEIGHT BREAKDOWN FOR THE BROKEN

FOLDOUT 60 kw/Wing Array

	Weight, kg
Blanket	143.70
Slip Ring Assembly	4.54
Cables	1.76
Drum	10.50
Shaft	6.44
Bearings	0.90
Center Support	8.92
Mast	36.40
Header	1.98
Leading Edge	1.96
Misc. Hardware	.50
Mast Canister	31.00
Tension Motor	23.6
Mast Sleeve	3.49
Drum Deployment Hinges & Structure & Lock	1.41
Drum Deployment Mechanism	1.56
Header Hinge & Lock	0.30
TOTAL	278.96

APPENDIX B

INVESTIGATIONS INTO THE DEFINITION OF FLATNESS CRITERIA

CONTENTS

APPENDIX B

INVESTIGATIONS INTO THE DEFINITION OF FLATNESS CRITERIA

This appendix contains the mathematical derivations for the flatness criteria and the associated power loss. Since several investigators have pursued flatness criteria, the appendix is divided into several sections summarizing the findings of each. The sections are self-contained, and the subject matter of some of the investigations overlap. The assumptions in some derivations differ slightly. The conclusions of all these investigations agree however that at 1 AU the estimated power loss due to an out of flatness of the array is negligible.

Where applicable the equations are derived as a function of temperature and can be used to evaluate out-of-flatness and power loss at various distances from the sun once the array temperatures are known.

The following subjects are treated in the appendix.

- Section I — On the Flatness of Thin Films
- Section II — Flatness Criteria for Solar Arrays
- Section III — Blanket Out-of-Flatness due to Boom Thermal Distortion

Since the subject of flatness in solar arrays has apparently not been systematically evaluated, the material presented in this appendix is considered to be a first step or a basis for further investigations, especially in the area of dynamics of very low frequency structures on the effect on power loss. This subject was not addressed in the parametric study. Some preliminary investigations into the dynamics of solar arrays are treated in References 16 through 19.

APPENDIX B

SECTION I

ON THE FLATNESS OF THIN FILMS

APPENDIX B

SECTION I

ON THE FLATNESS OF THIN FILMS

Dr. Michail Zak

SUMMARY

The effect of out-of-flatness of thin films on the power loss of solar arrays is examined. The out-of-flatness is assumed to be caused by a gravity field, uniform pressure loading, or thermal loads as well as film wrinkling due to non-uniform tension, non-uniform temperature distribution and non-parallel supports.

The derivation of the equations relating power loss to the various causes of film non-uniformity is based on some simplified assumptions which are clearly stated. An ideal thin film is assumed throughout all derivations.

1. The Cause of the Formation of Wrinkles in Thin Films

It can be shown, Ref. 18 and 19, that wrinkles in thin films appear as a result of film instability. The direction of the wrinkles run orthogonal to the direction of principal compression, Figure B1.

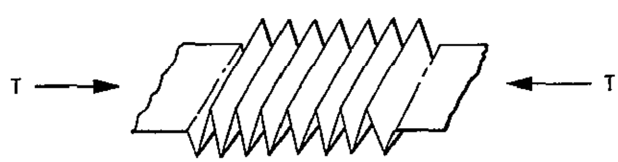


Figure B1.

Analytically this condition can be expressed as

$$T_{11}\, T_{22} < T_{12}^{2} \tag{B1}$$

where T_{11}, T_{12}, and T_{22} define the stress field of the film. Equation (B1) is valid only for an ideal film (without bending stiffness and with an infinitesimal

thickness). This limitation makes it impossible to study the internal geometry of the wrinkles within the framework of the model for an ideal film. This type of model does allow the introduction of the following relationship:

$$\tilde{h} = \max\ (1, 1-\varepsilon^0) \quad , \quad \varepsilon^0 < 0 \tag{B2}$$

where $\tilde{h}$ is the relative average bulge of the film as a result of the compression, and ε^0 is the principal deformation (strain) of compression. This relationship can be derived from the mass balance, Figure B2.

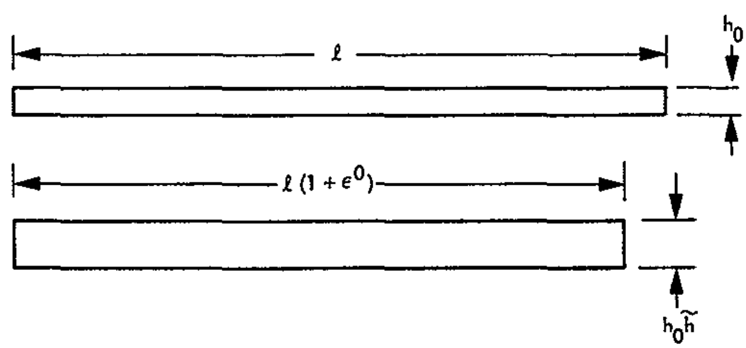


Figure B2.

$$\ell h_0 = \ell h_0\ (1+\varepsilon^0)\tilde{h} \quad ; \quad \tilde{h} = \frac{1}{1+\varepsilon^0} \approx 1 - \varepsilon^0 \tag{B3}$$

Thus,

$$\tilde{h} = 1 \text{ if } \varepsilon^0 > 0$$

$$\tilde{h} = 1 - \varepsilon^0 \text{ if } \varepsilon^0 < 0$$

2. The Internal Geometry of Wrinkles

The internal geometry of wrinkling can be studied by considering the finite thickness of the film, Figure B3. Then the effective angle of the wrinkled zone can be determined from the relationship

$$\tan \alpha = \tilde{h} - 1 \tag{B4}$$

ORIGINAL PAGE IS
OF POOR QUALITY

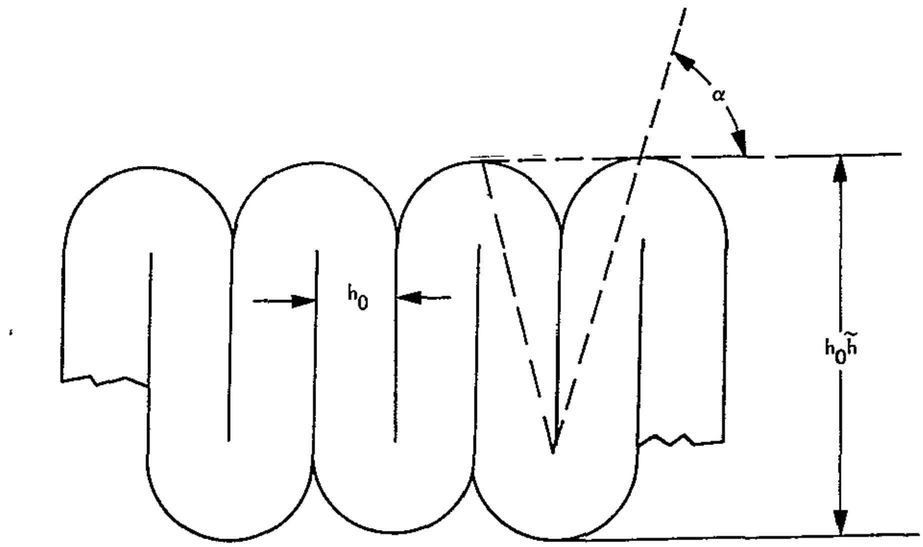


Figure B3.

Hence

$$\cos\alpha = \frac{1}{\sqrt{1 + (\tilde{h}-1)^2}} \tag{B5}$$

or

$$\cos\alpha = \frac{1}{\sqrt{1 + \frac{\varepsilon^{0^2}}{(1+\varepsilon^0)^2}}} \approx 1 - \frac{1}{2}\varepsilon^{0^2} \tag{B6}$$

The cosine of the effective angle α which defines the loss of solar energy is expressed by means of the film deformation ε^0 and subsequently can be introduced instead of ε^0 as a variable in the film equations.

3. Flatness Criteria

According to Lambert's cosine law the loss of ray energy absorbed by the surface is proportional to the expression

$$1 - \cos\phi \tag{B7}$$

where ϕ is the angle between the ray and the normal to the surface.

Assuming that in the ideal theoretical case rays fall normal to the plane of the solar array we can introduce the criterion of flatness from the energy loss point of view as

$$E = \frac{1}{\sigma} \int_{\sigma} \left[1 - \cos \phi \, (g_1, g_2) \right] d\sigma \tag{B8}$$

where σ is the surface area of the array and g_1, g_2 are coordinates defining the location of a point on that array surface. Equation (B8) is valid provided the solar flux is uniform at the surface. The function ϕ (g_1, g_2) is obtained from the solution of the equations of equilibrium of the film.

It is advantageous to divide the surface of the films into regions

$$\sigma = \sigma' + \sigma'' + \sigma''' \tag{B9}$$

where

σ' is the surface with curvature but without wrinkles

σ'' is the surface with wrinkles but without curvature

σ''' is the surface with wrinkles and curvature

then

$$\phi_{\sigma'} = \beta \tag{B10}$$

where β is the angle between the normal of the undeformed and deformed film, Figure B4.

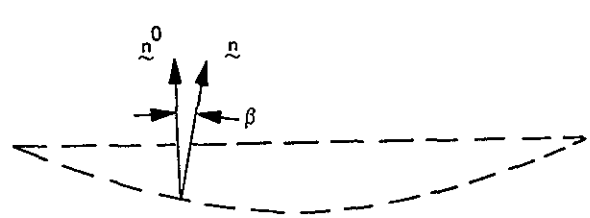


Figure B4.

$$\phi_{\sigma''} = \alpha = \arccos\left(1 - \frac{1}{2}\,\varepsilon^{0^2}\right) \approx \varepsilon^0 \qquad \text{(B11)}$$

and using Equation (B9)

$$\phi_{\sigma'''} = \beta \pm \alpha \qquad \text{(B12)}$$

Hence, using Equation (B8)

$$E = \frac{1}{2\sigma}\left\{\int_{\sigma'} \beta^2(g_1,g_2)\, d\sigma' + \int_{\sigma''} \varepsilon^{o^2}(g_1,g_2)\, d\sigma'' + \int_{\sigma'''} \left[\beta^2(g_1,g_2) + \varepsilon^{0^2}(g_1,g_2)\right] d\sigma'''\right\} \qquad \text{(B13)}$$

Furthermore it can be shown that β and ε^0 depend on the tension T, the change in temperature $\Delta\theta$ and the installation accuracy ξ. Thus we have

$$E = f(T,\Delta\theta,\xi) \qquad \text{(B14)}$$

The requirement to minimize the energy loss, E, leads to the requirement to optimize the parameters T, $\Delta\theta$, and ξ according to Equation (B14).

This optimization will be developed in the following sections.

4. Smooth Thin Film in a Gravity Field

The equation of a film with small curvature in a gravity field can be written as

$$y = \frac{\rho g}{2T_0} x\ (x-b) \quad , \quad z = 0\ (AB=b) \qquad \text{(B15)}$$

where T_0 is the tension, b is the film length, ρ is the film density and g is the gravitational acceleration. The coordinate system is defined in Figure B5.

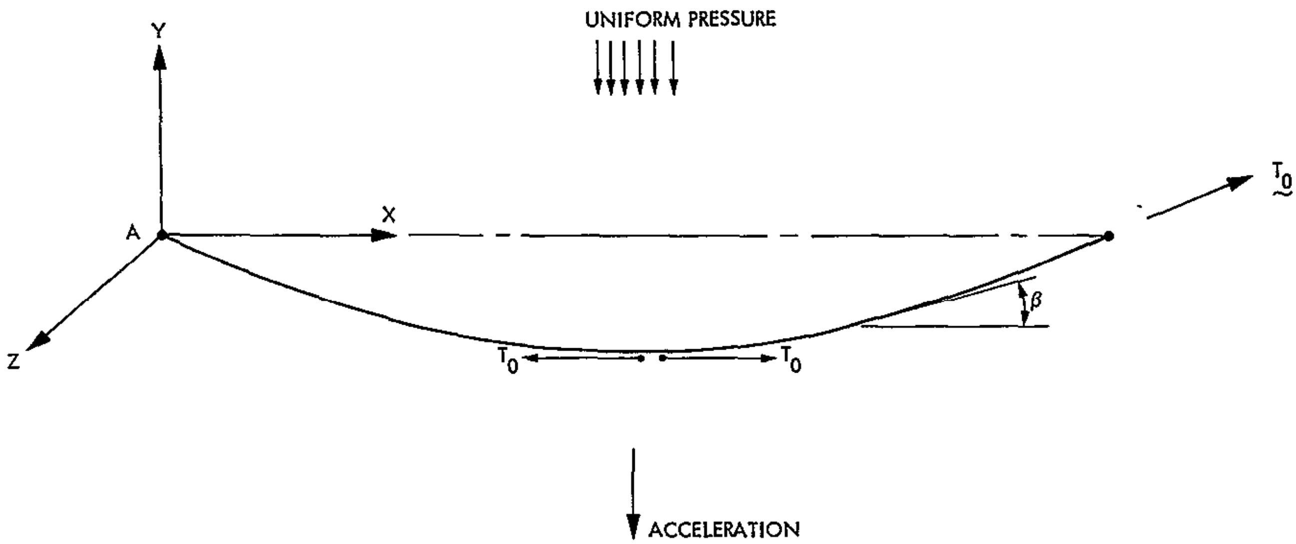


Figure B5. Thin Film Subjected to Uniform Pressure and Acceleration Loading Perpendicular to Plane of the Film

Equation (B15) is valid for $T_0 \gg \rho g b$. The following relationships can be deduced from Equation (B15):

$$\tan \beta = \frac{\rho g}{2T_0}(2x-b) \tag{B16}$$

$$\frac{\beta^2}{2} = 1 - \cos \beta \approx \left[\frac{\rho g}{2T_0}(2x-b)\right]^2 \tag{B17}$$

$$2E \approx \frac{\rho^2 g^2}{12}\,\frac{b^2}{T_0^2} = \frac{1}{12}\left(\frac{P}{T_0}\right)^2 \quad , \quad P = \rho g b$$

(B18)

$$E = \frac{1}{24}\left(\frac{P}{T_0}\right)^2$$

Consequently the loss of energy is inversely proportional to the square of the tension and the expression

$$E = \frac{1}{24}\left(\frac{P}{T_0}\right)^2$$

is an expression of the flatness criterion for a smooth film in a gravity field or any other uniform loading such as solar pressure. Figure B6 shows a plot of E versus the dimensionless parameter T_0/P for the range of interest.

The criterion can be expressed in other forms. If the film length ℓ is introduced the following relationships can be derived:

$$\ell \approx b \sqrt{1 + \frac{\rho^2 g^2 b^2}{12 T_0^2}} \qquad \text{(B19)}$$

$$\frac{\ell}{b} = \sqrt{1 + \frac{1}{12}\left(\frac{P}{T_0}\right)^2} = \sqrt{1 + 2E}$$

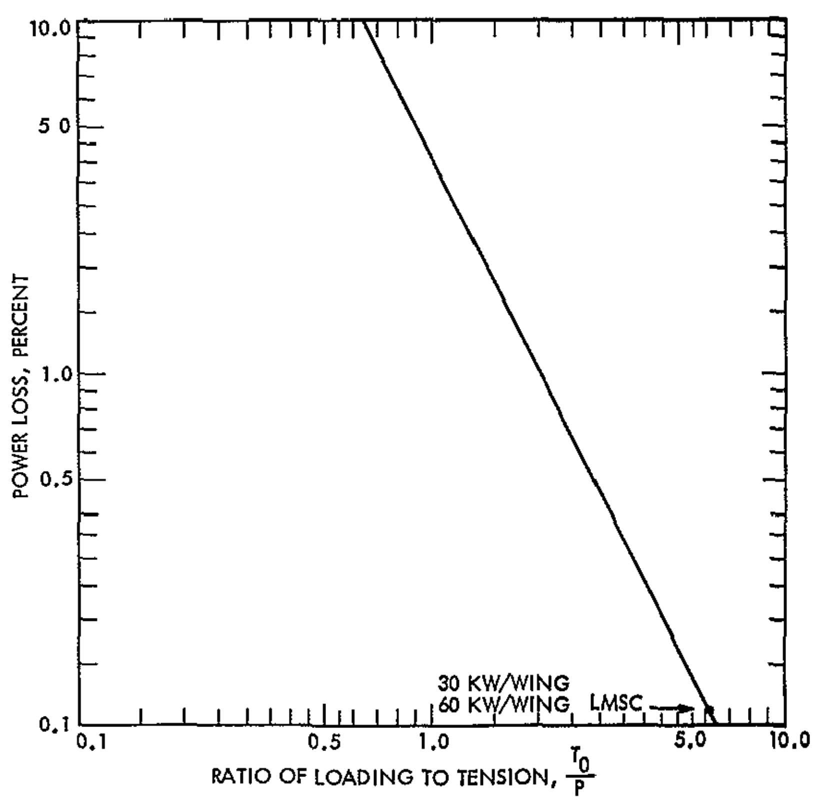


Figure B6. Power Loss Due to Uniform Loading Acceleration or Solar Pressure

Hence

$$E = \frac{1}{2}\sqrt{\left(\frac{\ell}{b}\right)^2 - 1} \tag{B20}$$

If it is assumed that the film is elongated uniformly as a result of a uniform heat flux

$$\Delta\tilde{e} = \frac{\Delta\ell}{\ell} \approx \frac{\Delta\ell}{b} = \alpha\ \Delta\theta \tag{B21}$$

Then according to Equation (B20) onė obtains

$$E \approx \frac{1}{2}\ \sqrt{\left(\frac{\ell}{b} + \alpha\ \Delta\theta\right)^2 - 1} \tag{B22}$$

Consequently a temperature increase reduces the efficiency of the film surface if the slack due to thermal expansion is not compensated for. The most pronounced reduction in power occurs at small ($\ell/b - 1$) and $\Delta\tilde{e}$. Note that in the case considered above the flatness can be restored by compensating for the slack which was caused by film elongation. Since most solar arrays contain a constant tension device, the above case is only of interest if the device should fail and the distance between supports is kept constant. Figures B7(a) and B7(b) show the effect of temperature and strain rate for non-constant tension films. These curves have been generated for Kapton film, $\alpha = 2 \times 10^{-5}$ in/in/°C, and are representative of solar array strains with $E = 0.43 \times 10^6$ lb/in^2 for Kapton.

If it is assumed that the heat flux is non-uniform across the width of the film, δ, then the elongations can be approximated by

$$\Delta\tilde{e} = \Delta e_0\ \frac{z}{\delta} \tag{B23}$$

Neglecting the effect of local transverse tension which can appear halfway across the width as a result of the formation of double curvature and which is exactly zero at the film edge, one concludes that the principal direction of the longitudinal tension is not changed. In this case Equation (B19) is applicable and Equation (B22) now becomes

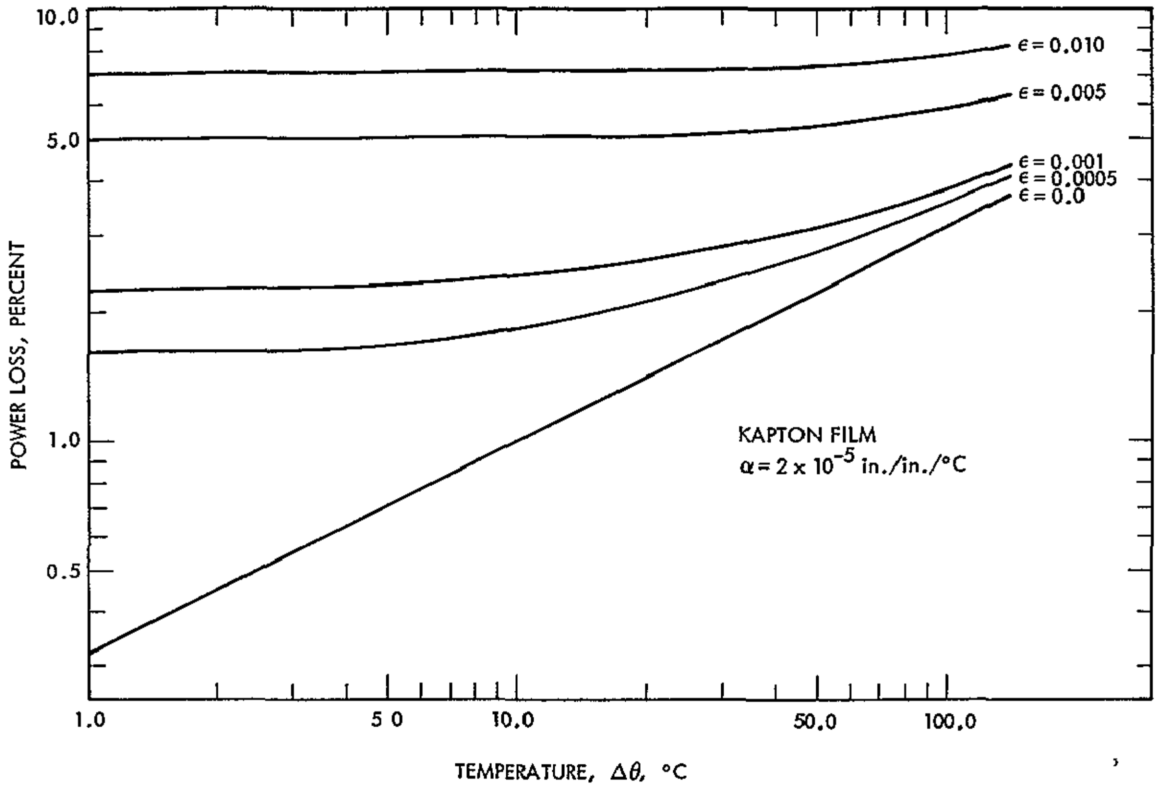


Figure B7(a). Effect of Temperature on Power Loss

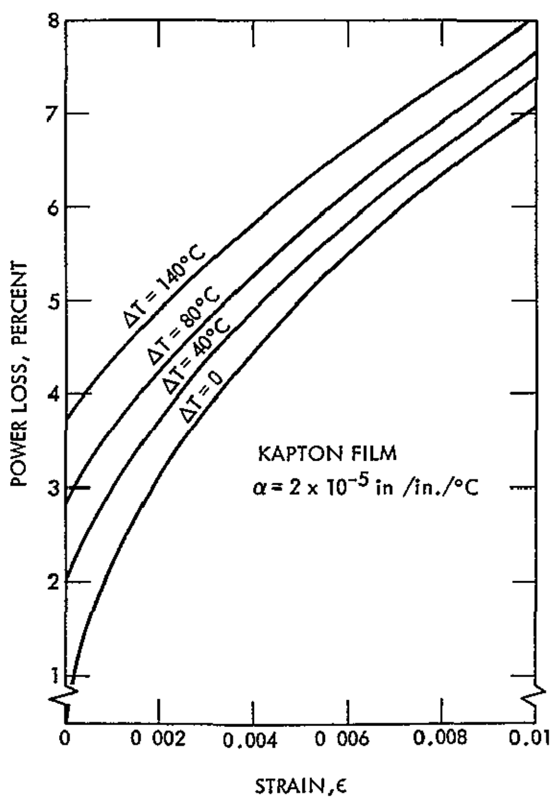


Figure B7(b). Effect of Strain on Power Loss

$$E = \frac{1}{2\delta} \int_0^{\delta} \sqrt{\left(\frac{\ell}{b} + \frac{\Delta\tilde{e}_0}{\delta} z\right)^2 - 1} \; dz$$

$$E = \frac{1}{2} \sqrt{\left(\frac{\ell}{b} + \frac{1}{2} \Delta\tilde{e}_0\right)^2 - 1} \tag{B24}$$

Power loss as a function of temperature variation across the film width is shown in Figure B7(c) for Kapton film.

Note that the results of Figure B7(c) can be obtained from Figure B7(a) with

$$\Delta\tilde{e}_0 \longrightarrow \frac{1}{2} \Delta\tilde{e}_0 \tag{B25}$$

In contrast to the previous case, however, the loss of power cannot be corrected by increasing the tension since the latter is not uniform.

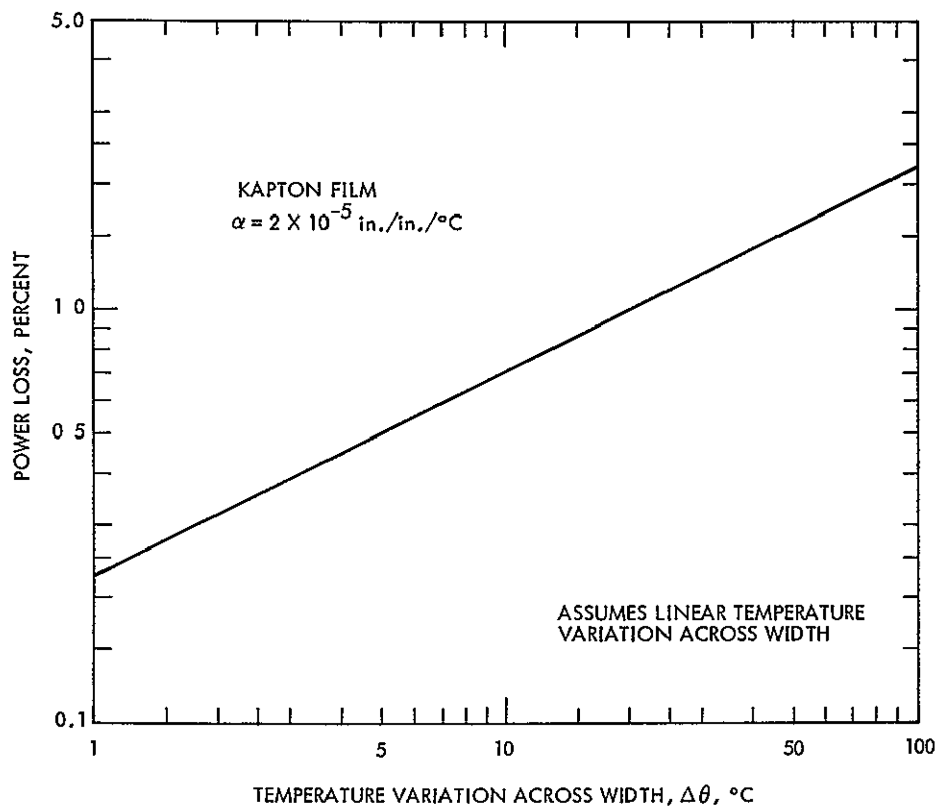


Figure B7(c). Effect of Temperature Variation Across Width on Power Loss

5. Wrinkled Film in a Gravity Field

a) Non-Uniform Tension across the Film Width

It will be assumed that the tension varies along the width linearly,

$$T = T_0 + \Delta T \frac{z}{\delta} \tag{B26}$$

The shape of the film depends only on the highest tension value T_1, due to the assumption that the film extension is negligible. If any tension value $T(z)$ would determine the shape of any line z = constant, the film would have double curvature, which is in contradiction of the original assumption that the Gauss curvature is zero. For inextensible films the Gauss curvature does not change at all.

Hence the length of the film is defined by

$$\ell = b \sqrt{1 + \frac{1}{12} \left(\frac{P}{T_1}\right)^2} \approx b \left(1 + \frac{1}{12} \frac{P}{T_0 + \Delta T}\right) \tag{B27}$$

The contraction of the lines z = constant can be written in the following form

$$\varepsilon^0 = \frac{\Delta T}{T_0} \left(\frac{z}{\delta} - 1\right) \tag{B28}$$

Then the additional power loss as a result of the formation of wrinkles can be evaluated by

$$E' = \frac{1}{2\sigma} \int_\sigma \varepsilon^{0^2} \, d\sigma = \frac{1}{2\delta} \int_0^\delta \left[\Delta T \left(\frac{z}{\delta} - 1\right)\right]^2 dz ,$$

$$E' = \frac{1}{6} \left(\frac{\Delta T}{T_0}\right)^2 \tag{B29}$$

The power loss as a function of tension variation across the film width is plotted in Figure B8.

b) Variable Angle of Gravity Vector to Blanket Surface

First the extreme case will be considered wherein the gravity vector is in the plane of the film perpendicular to the length of the film. This case is illustrated in Figure B9.

It can be shown that as a first approximation the lines of direction for the principal tension can be considered as free threads and equations (B15) and (B16) are valid. The contraction of the film along the width can be expressed as:

$$\varepsilon^0 = \cos\beta - 1 = -\left[\frac{\rho g}{2T_0}(2x-b)\right]^2 \tag{B30}$$

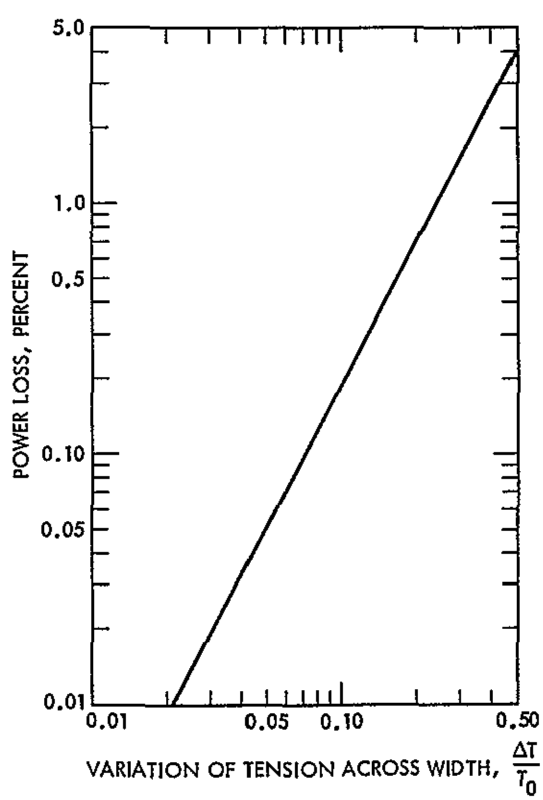


Figure B8. Effect of Tension Variation Across Width on Power Loss

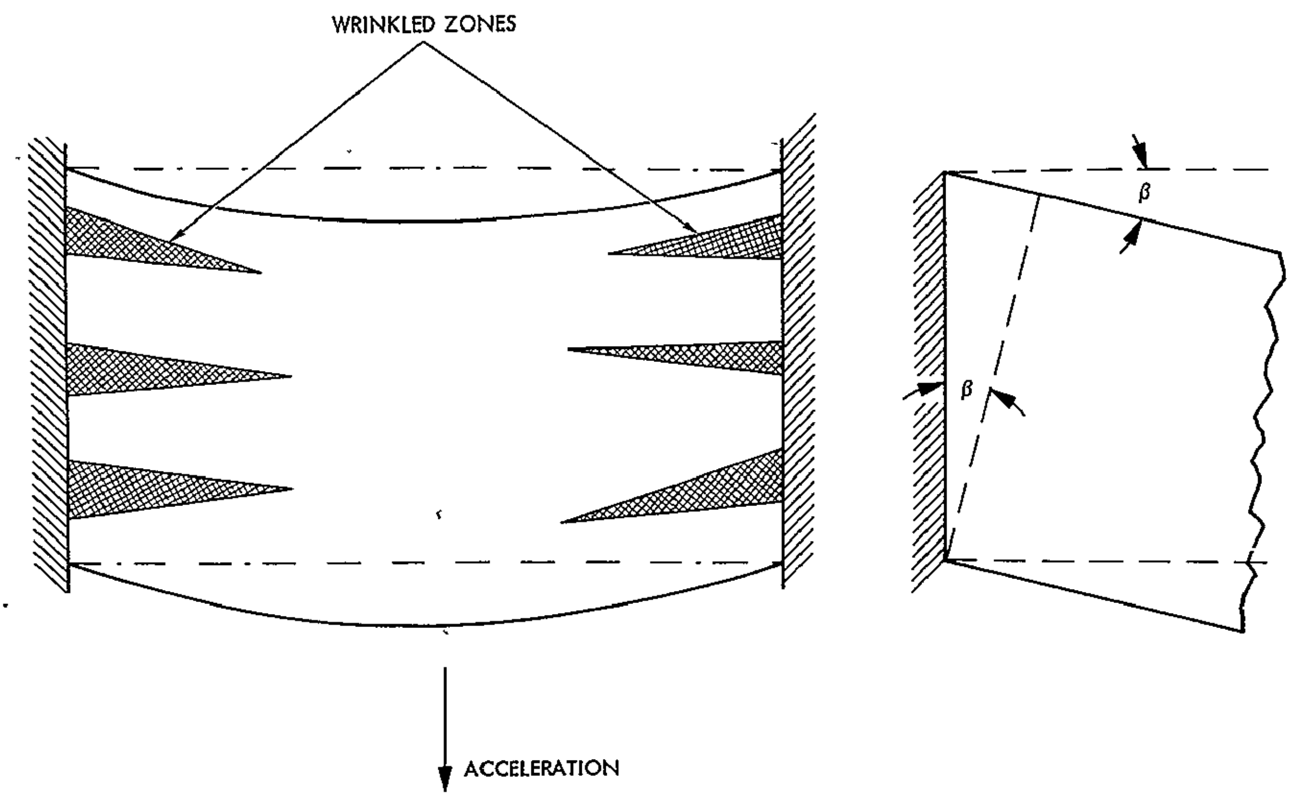


Figure B9. Thin Film Subjected to Acceleration Loading in the Plane of the Film

and using Equation (B13)

ORIGINAL PAGE IS OF POOR QUALITY

$$E = \frac{1}{2b} \int \left[\frac{\rho g}{2T_0} (2x-b) \right]^4 dx = \frac{1}{80} \left(\frac{P}{T_0} \right)^4 \tag{B31}$$

Now the more general case when the gravity vector slopes to a line along the width of the film by an angle γ will be considered. This case is illustrated in Figure B10.

For this case Equations (B18) and (B31) can be superimposed leading to:

$$E = \frac{1}{24} \left(\frac{P}{T_0} \right)^2 \cos \gamma + \frac{1}{80} \left(\frac{P}{T_0} \right)^4 \sin \gamma \tag{B32}$$

Figures B11(a) and B11(b) show the effect of the sloping film on the loss of power.

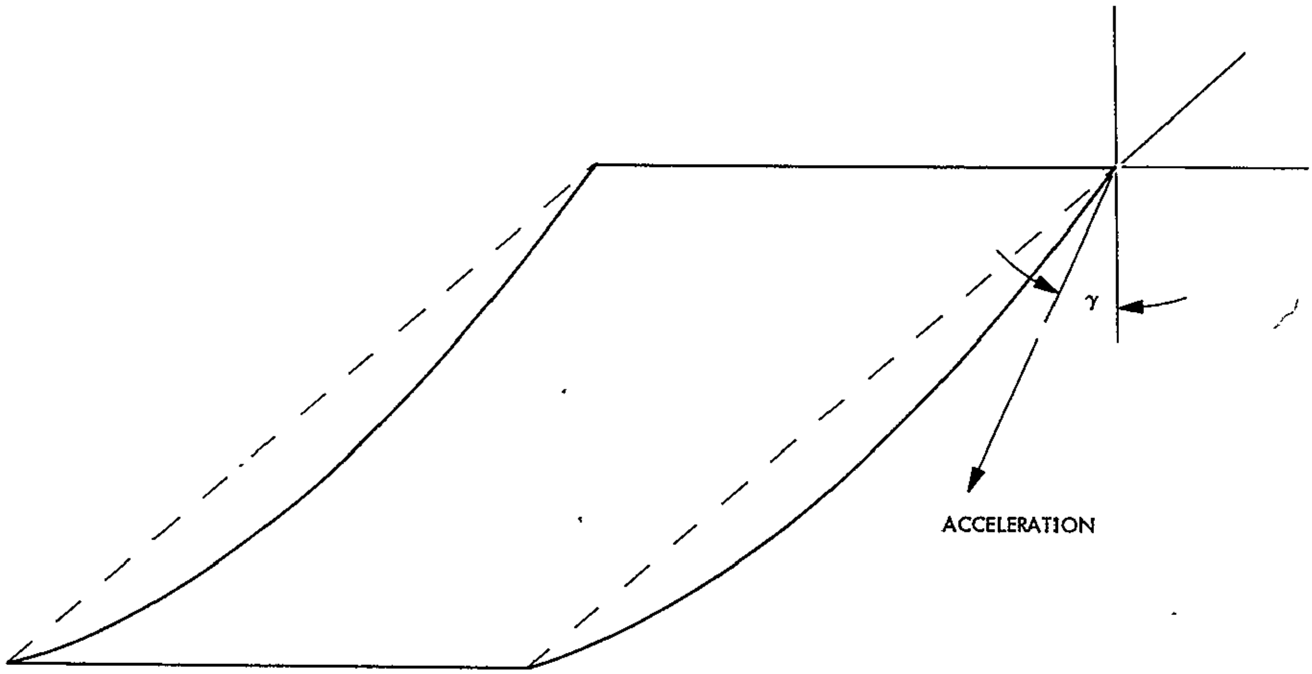


Figure B10. Thin Film Subjected to Acceleration Loading at Angle to the Plane of the Film

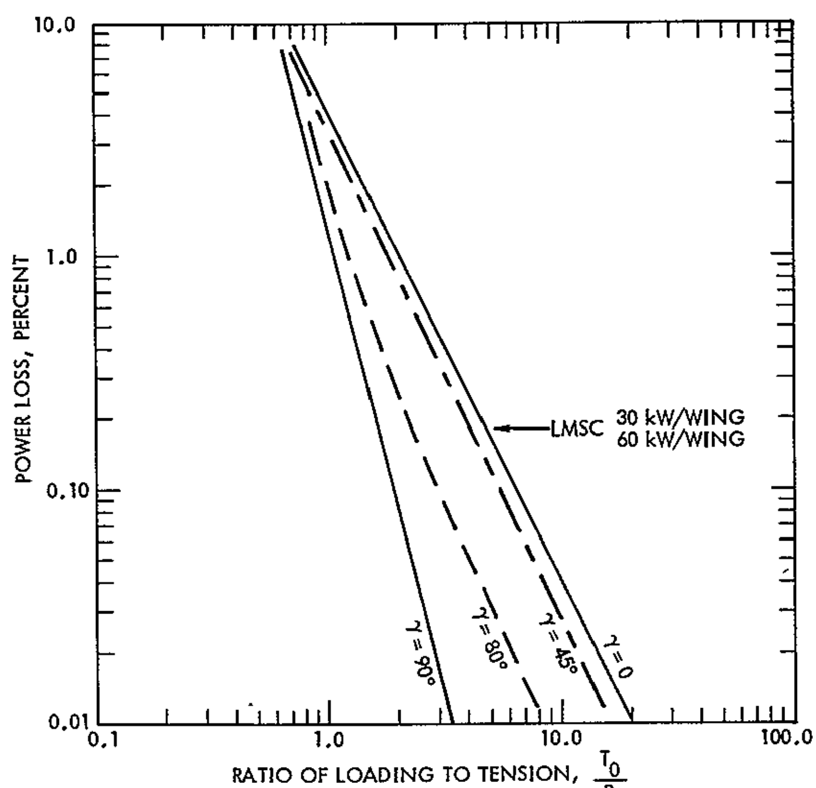


Figure B11(a). Power Loss due to Acceleration Loading for Various Angles

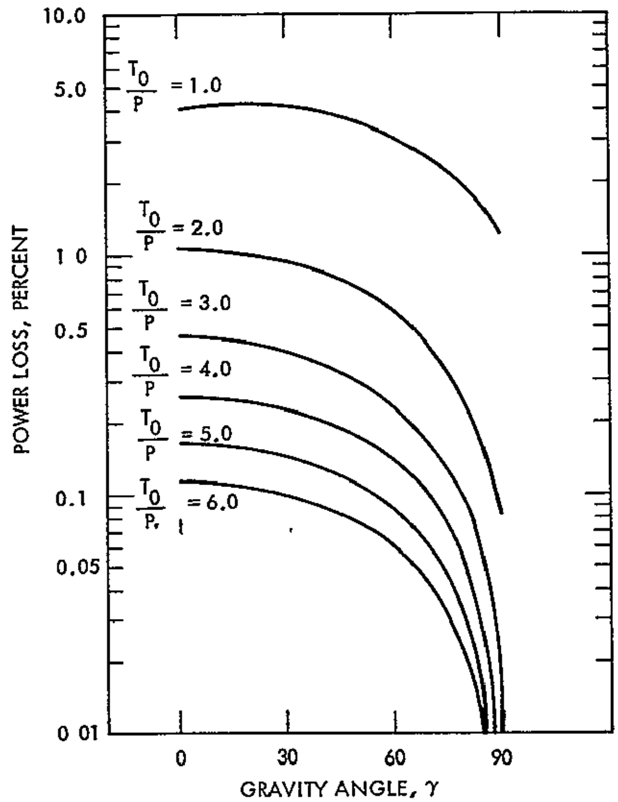


Figure B11(b). Power Loss due to Acceleration Loading for Various Angles

c) Non-Parallel In-Plane Supports

If the supports are assumed to be non-parallel in the plane of the film by an angle λ, contraction at the edge of the film will occur, Figure B12. This can be defined by

$$\varepsilon^0 = -\lambda^2 \frac{x}{b} \tag{B33}$$

Then using Equation (B13)

$$E = \frac{1}{2b} \int_0^b \lambda^4 \frac{x^2}{b^2} dx = \frac{\lambda^4}{6} \tag{B34}$$

Power loss as a function of the misalignment angle is shown in Figure B13.

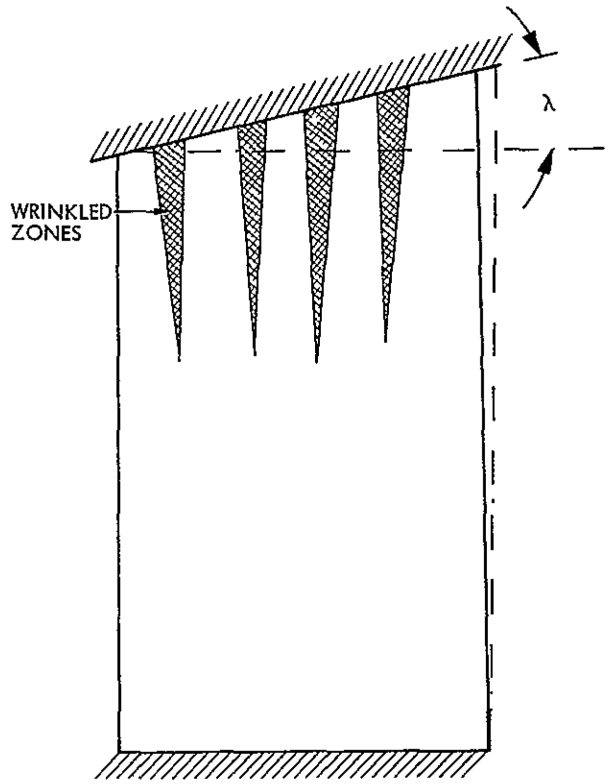


Figure B12. Deformation of Thin Film Due to Non-Parallel Supports in the Plane of the Film

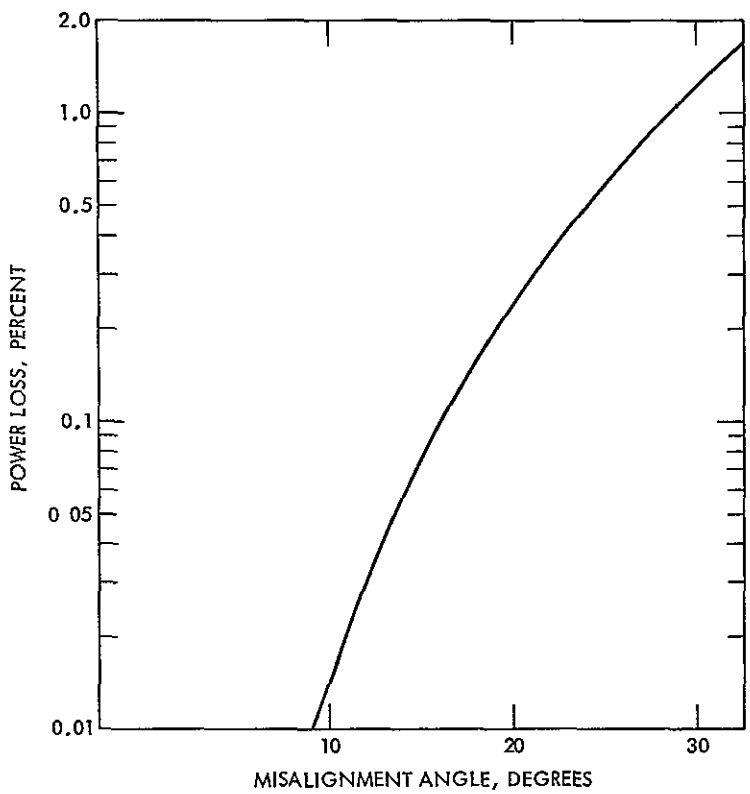


Figure B13. Power Loss as a Function of Non-Parallel in Plane Supports

d) Non-Parallel Out of Plane Support (Film Tension)

Next a misalignment by a relative rotation, Ω, of the supports out of plane of the film will be considered, Figure B14. Then,

$$\beta = \Omega \frac{x}{b} \tag{B35}$$

and the contraction along the Z-axis is given by

$$\varepsilon^0 = \left(\Omega \frac{x}{b}\right)^2 \tag{B36}$$

and using Equation (B13)

$$E = \frac{1}{2b} \int_0^b \left[\Omega \frac{x}{b} + \left(\Omega \frac{x}{b}\right)^2\right] dx \approx \frac{\Omega}{4} + \frac{\Omega^2}{6} \tag{B37}$$

The power loss as a function of film twist angle is plotted in Figure B15.

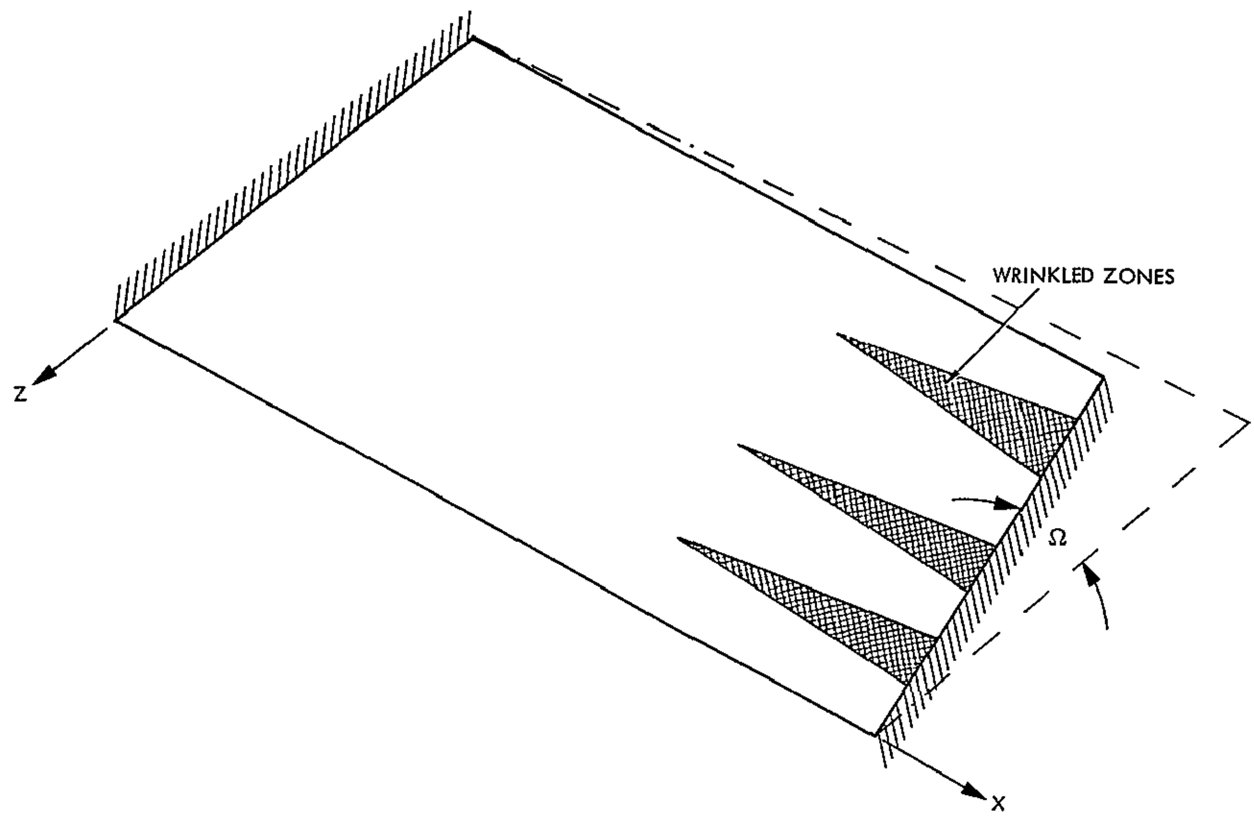


Figure B14. Deformation of Thin Film due to Non-Parallel Supports Out of the Plane of the Film

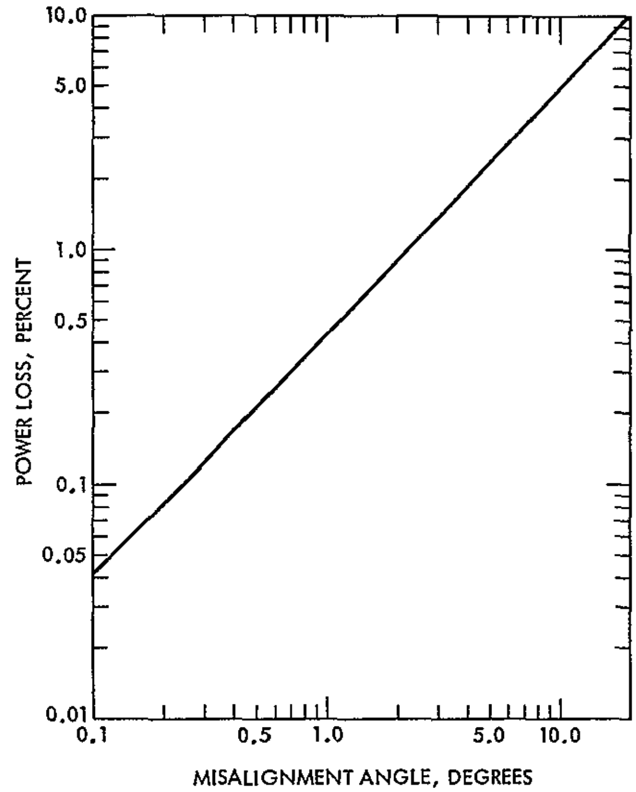


Figure B15. Power Loss as a Function of Non-Parallel Out of Plane Supports

e) Parallel Shift between Supports

The film is subjected to pure shear by an in-plane relative linear displacement of the supports. See Figures B16 and B17.

It can be shown that such a shear deformation is equivalent to an extension ε along AB ($X = 45°$)

$$\varepsilon = x\,(2 - \sqrt{2}) \tag{B38}$$

and a corresponding contraction ε^0 in a direction orthogonal to AB

$$\varepsilon^0 = x\,(\sqrt{2} - 2) \tag{B39}$$

Since the edges of the film are free, two stress regimes are formed: the Stressed Zone I and the Slack Zone II.

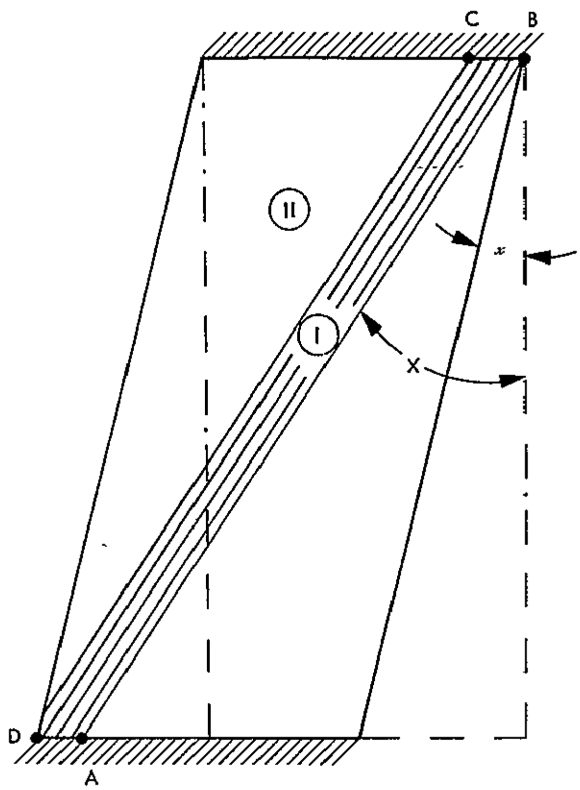


Figure B16. Effect of Parallel Shifts Between Supports on Deformation of Thin Film

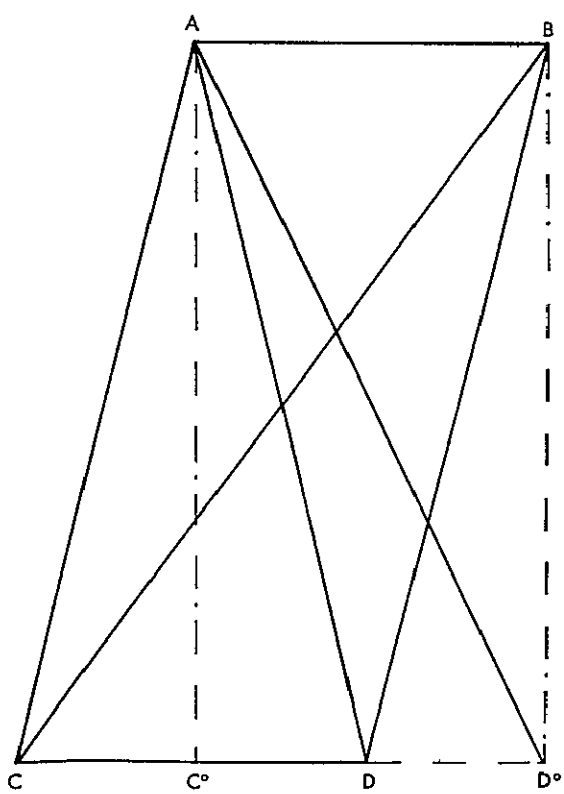


Figure B17. Effect of Parallel Shifts Between Supports on Deformation of Thin Film

Performing a simple geometric transformation the width of the stressed zone CD can be evaluated as follows:

$$CD = \Delta = \delta + b\ (\varkappa - 1) \qquad \frac{\delta}{b} > 1 \tag{B40}$$

The fraction of the area which is stressed is given by

$$\eta = \frac{\delta}{b} + \varkappa - 1 \tag{B41}$$

Hence, as a result of the contraction of the stressed zone and the formation of wrinkles we have

$$E' = \frac{\varepsilon_0^2}{2}\left(\frac{\delta}{b} + \varkappa - 1\right) = 0.18\,\varkappa^2\left(\frac{\delta}{b} + \varkappa - 1\right), \qquad \frac{\delta}{b} > 1 \tag{B42}$$

For sufficiently long (high aspect ratio) films the stressed area degenerates into a line ($\Delta = 0$, $\varepsilon' = 0$).

If $\delta/b > 0$, we arrive at the situation shown in Figure B17. Only the diagonal will be under tension. The other areas will be slack. The contraction of the slack area in the direction $\overline{AD}$ can be evaluated by the following:

$$\varepsilon^0 = \frac{\sqrt{b^2 + (\delta - b\varkappa)^2}}{\sqrt{b^2 + \delta^2}} - 1 \approx \frac{b\delta}{b^2 + \delta^2}\,\varkappa = -\frac{\varkappa}{\frac{b}{\delta} + \frac{\delta}{b}} \tag{B43}$$

Hence,

$$E' = \frac{\varkappa^2}{2\left(\frac{b}{\delta} + \frac{\delta}{b}\right)^2} \tag{B44}$$

A plot of the power loss as a function of parallel shifts of the supports for various aspect ratios is shown in Figure B18.

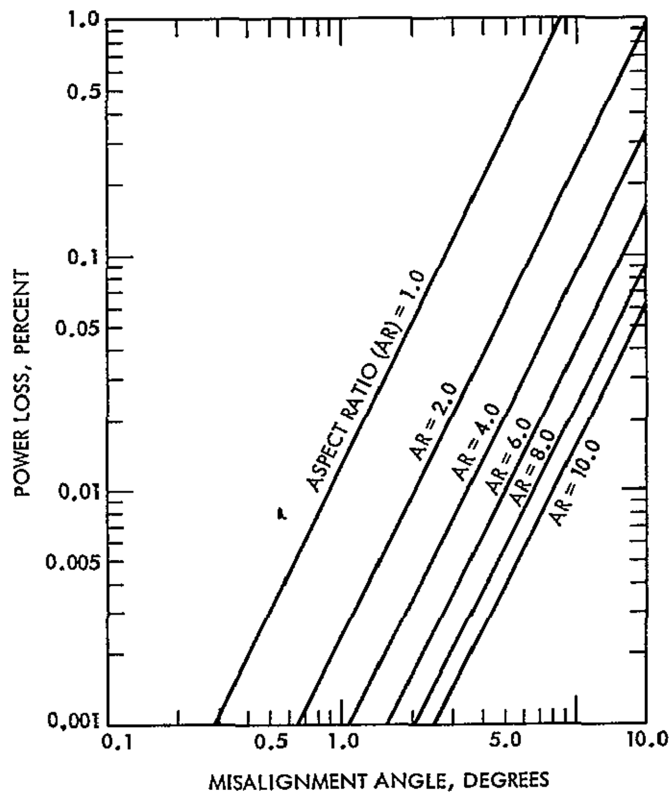


Figure B18. Power Loss as a Function of Parallel Shift Between Supports

6. Formulation of the Flatness Criteria

Summarizing the results of the previous sections the following requirements on the film parameters can be defined:

$$\frac{1}{24}\left(\frac{P}{T_0}\right)^2 \cos\gamma + \frac{1}{2}\sqrt{\left(\frac{\ell}{b} + \frac{1}{2}\Delta\tilde{e}_0\right)^2 - 1} + \frac{1}{6}\left(\frac{\Delta T}{T_0}\right)^2$$

$$+ \frac{1}{80}\left(\frac{P}{T_0}\right)^4 \sin\gamma + \frac{\lambda^4}{6} + \frac{\Omega}{4} + \frac{\Omega^2}{6} \tag{B45}$$

$$+ \frac{\alpha^2}{2\left(\frac{b}{\delta} + \frac{\delta}{b}\right)^2} \le E_0$$

where E_0 is the required surface efficiency.

APPENDIX B

SECTION II

FLATNESS CRITERIA FOR SOLAR ARRAYS

APPENDIX B

SECTION II

FLATNESS CRITERIA FOR SOLAR ARRAYS

Dr. J.C. Chen

The out-of-flatness of the solar array will be considered as arising from four sources, namely:

1. Local Effects

   A thin membrane mounted on a rigid frame will be considered. The membrane deforms due to the loads applied on its surface.

2. Global Effects

   The entire solar array will be considered as a membrane whose stiffness is provided by the tension applied at the edges. Due to the elongated configuration, the solar array will be approximated as a one dimensional structure.

3. Manufacturing Effects

   The effects of initial out-of-flatness to the deformation due to external loads will be considered.

4. Thermal Effects

   Due to the temperature gradient, ΔT, the membrane will expand. The in-plane expansion will cause out-of-plane slacks once the external load is applied. The relationship between the temperature gradient ΔT and the resulting out-of-plane deformation will be obtained.

In all three cases, the external loading is due to the steady state (constant) acceleration and/or the solar pressure. The loading is assumed to be normal to the membrane surface.

The effects of the out-of-flatness are related to the efficiency of the solar array. The efficiency is defined as the cosine of the surface due to out-of-flatness.

1. Local Effects

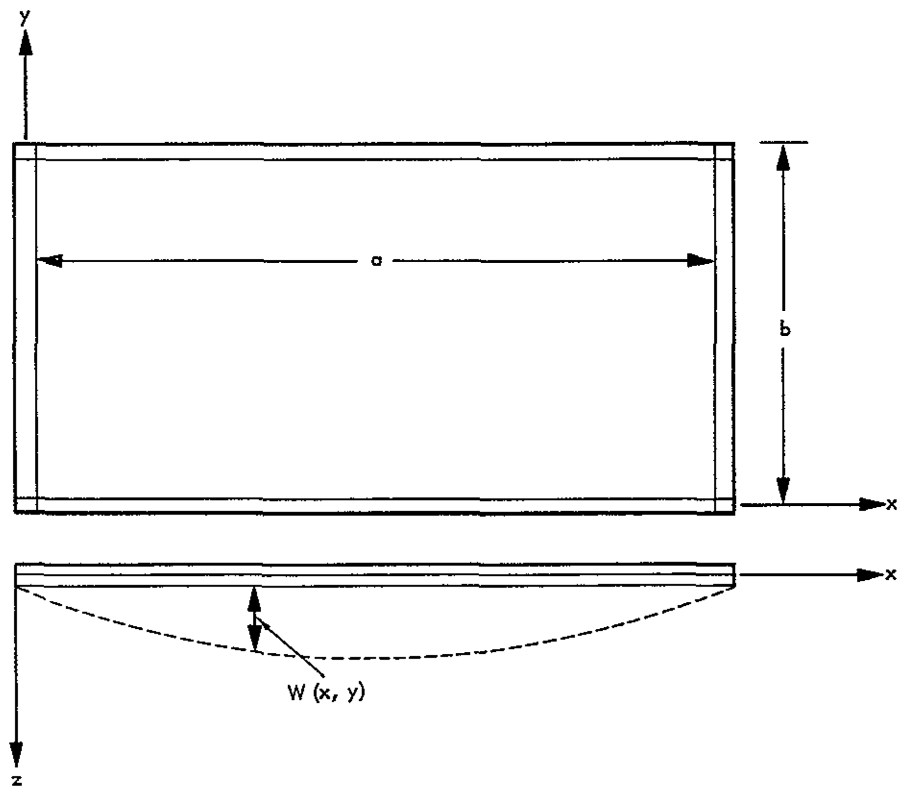


Figure B19. Membrane Schematic

$$w(x,y) = w_0 h \sin\left(\frac{\pi x}{a}\right) \sin\left(\frac{\pi y}{b}\right) = \text{out-of-plane deformation}$$

$$w_0 = 0.643 \left(\frac{1}{\gamma^4 + 1} \; \frac{qb^4}{Eh^4}\right)^{1/3} \tag{B46}$$

h = membrane thickness

a = panel length

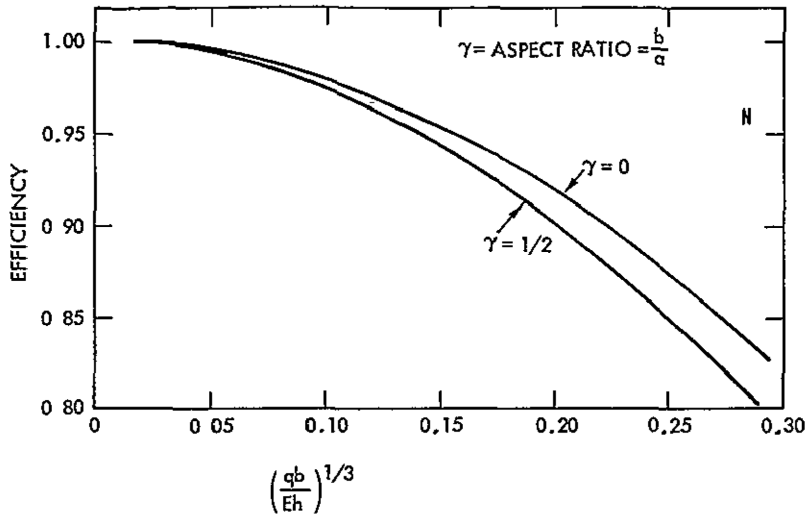
b = panel width

q = external loads normal to the surface

E = Modulus of Elasticity

γ = aspect ratio = $\frac{b}{a}$

$$\text{Efficiency} = \cos\left(\left.\frac{\partial w}{\partial x}\right|_{max}\right) \cdot \cos\left(\left.\frac{\partial w}{\partial y}\right|_{max}\right) \tag{B47}$$



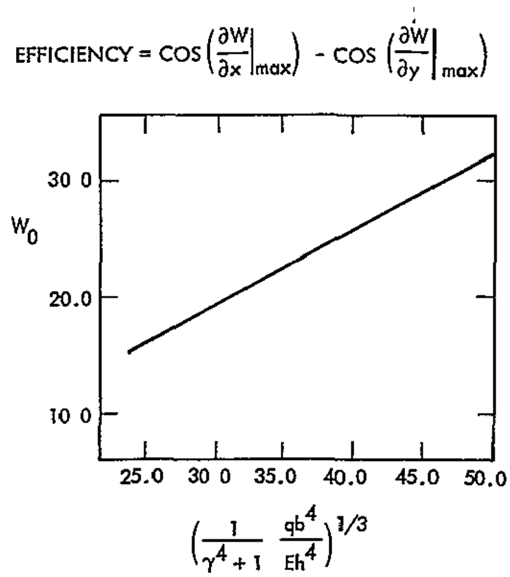


Figure B20(a). Non-Dimensional Deflection and Efficiency - Local Effects

Example: Foldout Array Panel by LMSC

$a = 157.5$ in.

$b = 29.78$ in.

$h = 10^{-3}$

$E = 4.3 \times 10^{5}$ psi

$\rho = 1.27 \times 10^{-3}$ lb/in.^{2}

Acceleration $= 10^{-3}$ g

$q = \rho \cdot \text{Acc.} = 1.27 \times 10^{-6}$ lb/in.^{2}

$$\frac{qb}{Eh} = \frac{1.27 \times 10^{-6} \times 29.78}{4.3 \times 10^{5} \times 10^{-3}} = 8.796 \times 10^{-8}$$

$$\frac{\gamma^3}{\gamma^4 + 1} = 0.00675$$

$$\frac{1}{\gamma^4 + 1} = 0.9987$$

$$\left.\frac{\partial w}{\partial x}\right|_{max} = 2.02 \left(\frac{\gamma^3}{\gamma^4 + 1} \; \frac{qb}{Eh} \right)^{1/3} = .170 \times 10^{-2}$$

$$\left.\frac{\partial w}{\partial y}\right|_{max} = 2.02 \left(\frac{1}{\gamma^4 + 1} \; \frac{qb}{Eh} \right)^{1/3} = 8.980 \times 10^{-3}$$

Efficiency = 0.99999 ≈ 1.0

2. Global Effects

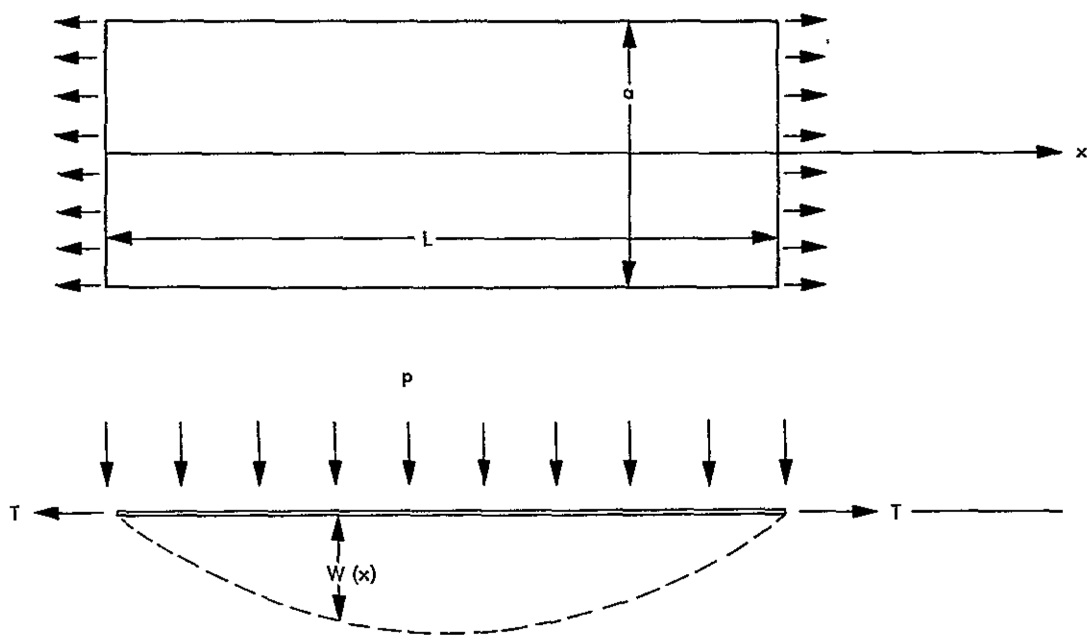


Figure B20(b). Membrane Schematic

$$w(x) = \frac{px}{2T} (L-x)$$

$$p = q \cdot a$$

$$\text{Efficiency} = \cos \left(\left.\frac{\partial w}{\partial x}\right|_{max} \right) \tag{B48}$$

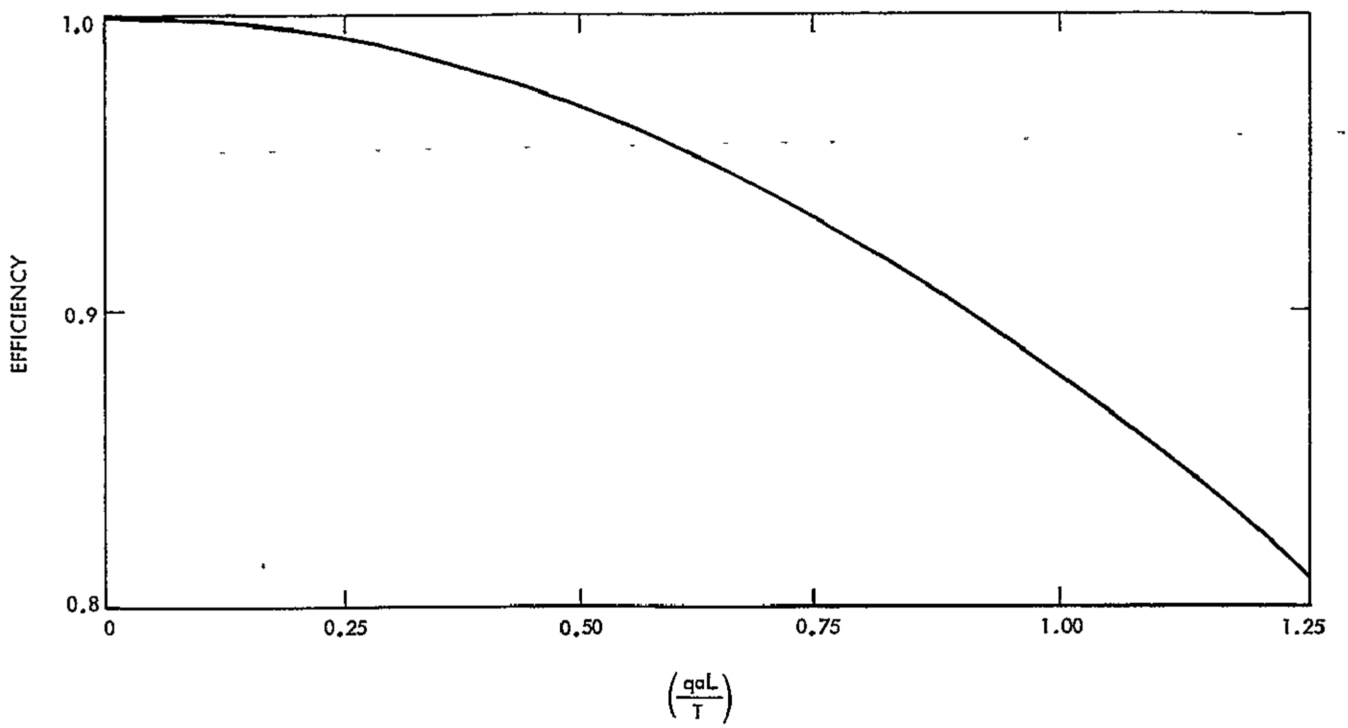


Figure B21. Non-Dimensional Efficiency - Global Effects

<u>Example:</u> For the LMSC Foldout Array

$a = 157.5$ in.

$L = 1.221 \times 10^3$ in.

$q = 1.27 \times 10^{-7}$ psi

$T = 3.0$ lbs

$$\left.\frac{dw}{dx}\right|_{max} = 0.0041$$

Efficiency $= 0.999 \approx 1.0$

3. Manufacturing Effects

Initial out-of-flatness may exist due to the manufacturing defects. These effects will be expressed mathematically as the initial deflections normal to the surface, w_0 (x,y), which is a function of the surface coordinates x, y.

Next, it will be assumed that the initial deflection w_0 (x,y) can be expanded into a Fourier series:

$$w_0(x,y) = \sum_m \sum_n A_{mn} \sin\left(\frac{m\pi x}{a}\right) \sin\left(\frac{n\pi y}{b}\right) \tag{B49}$$

Due to the nature of the external loading on the membrane the first term in the series (m = n = 1) is the most important term; therefore,

$$w_0(x,y) \cong A_0 \sin\left(\frac{\pi n}{a}\right) \sin\left(\frac{\pi y}{b}\right) \tag{B50}$$

Again the deflection due to the external loading will be expressed as

$$w(x,y) = A \sin\left(\frac{\pi n}{a}\right) \sin\left(\frac{\pi y}{b}\right) \tag{B51}$$

The efficiency is defined as:

$$\text{Efficiency} = \cos\left[\left.\frac{\partial(w+w_0)}{\partial x}\right|_{max}\right] \cdot \cos\left[\left.\frac{\partial(w+w_0)}{\partial y}\right|_{max}\right] \tag{B52}$$

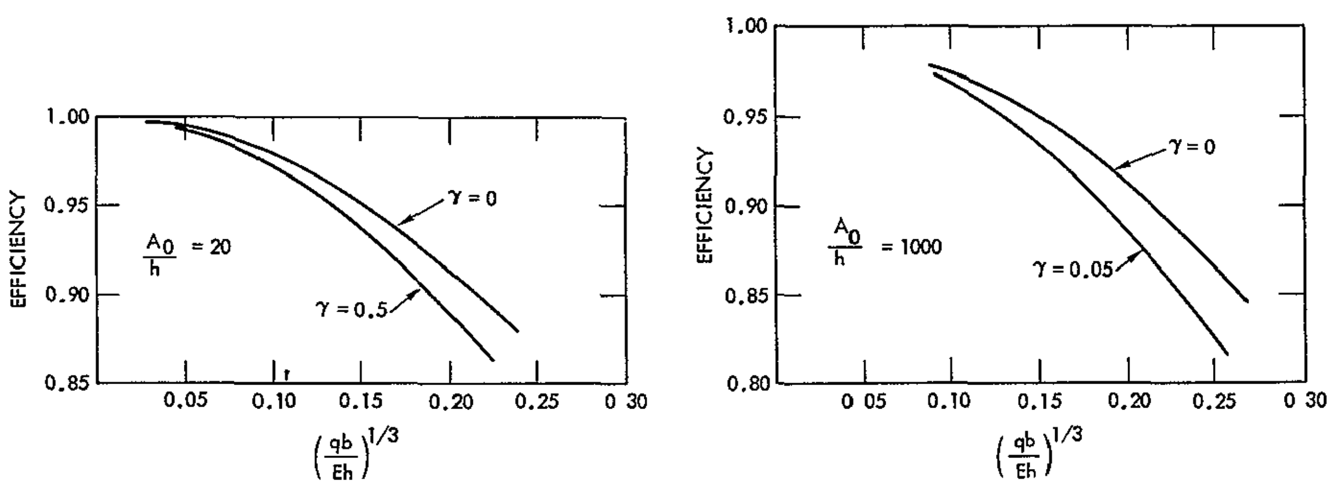


Figure B22. Non-Dimensional Efficiency - Manufacturing Effects

4. Thermal Effects

The out-of-plane deflection will be assumed as

$$w(x,y) = A \sin\left(\frac{\pi n}{a}\right) \sin\left(\frac{\pi y}{b}\right) \tag{B53}$$

The area of the deformed surface is

$$\text{Area} = \int_0^a \int_0^b \left[1 + \left(\frac{\partial w}{\partial x}\right)^2\right]^{1/2} \cdot \left[1 + \left(\frac{\partial w}{\partial y}\right)^2\right]^{1/2} dx\ dy \tag{B54}$$

$$\cong \int_0^a \int_0^b \left[1 + \left(\frac{\partial w}{\partial x}\right)^2 + \left(\frac{\partial w}{\partial y}\right)^2\right]^{1/2} dx\ dy \tag{B55}$$

$$\cong \int_0^a \int_0^b \left[1 + \frac{1}{2}\left(\frac{\partial w}{\partial x}\right)^2 + \frac{1}{2}\left(\frac{\partial w}{\partial y}\right)^2\right] dx\ dy$$

$$= ab + \frac{\pi^2}{8} \left(\frac{a^2+b^2}{ab}\right) A^2 \tag{B56}$$

However, the area due to in-plane thermal expansion is

$$\overline{\text{Area}} = (1+\alpha\Delta T)a \cdot (1+\alpha\Delta T)b = (1+\alpha\Delta T)^2\ ab \cong ab + 2\alpha\Delta T \cdot ab \tag{B57}$$

Let

$$\text{Area} = \overline{\text{Area}}$$

$$A = \frac{4}{\pi} \frac{ab\ \sqrt{\alpha\Delta T}}{\left(a^2+b^2\right)^{1/2}} \tag{B58}$$

$$\text{Efficiency} = \cos\left(\left.\frac{\partial w}{\partial x}\right|_{max}\right) \cdot \cos\left(\left.\frac{\partial w}{\partial y}\right|_{max}\right) \tag{B59}$$

$$\left.\frac{\partial w}{\partial x}\right|_{max} = \frac{4b}{\sqrt{a^2+b^2}} \sqrt{\alpha \Delta T} \quad , \quad \left.\frac{\partial w}{\partial y}\right|_{max} = \frac{4a}{\sqrt{a^2+b^2}} \sqrt{\alpha \Delta T} \qquad \text{(B60)}$$

a = 157.5 in.

b = 29.78 in.

$\alpha = 2.0 \times 10^{-5}$ in/in/°C

ΔT °C	1	2	5	10	20	50	100
$\ell n\ (\Delta T)$	0	0.6932	1.6094	2.3026	2.9957	3.9120	4.6052
Efficiency	0.9998	0.9997	0.9992	0.9984	0.9968	0.9920	0.9841

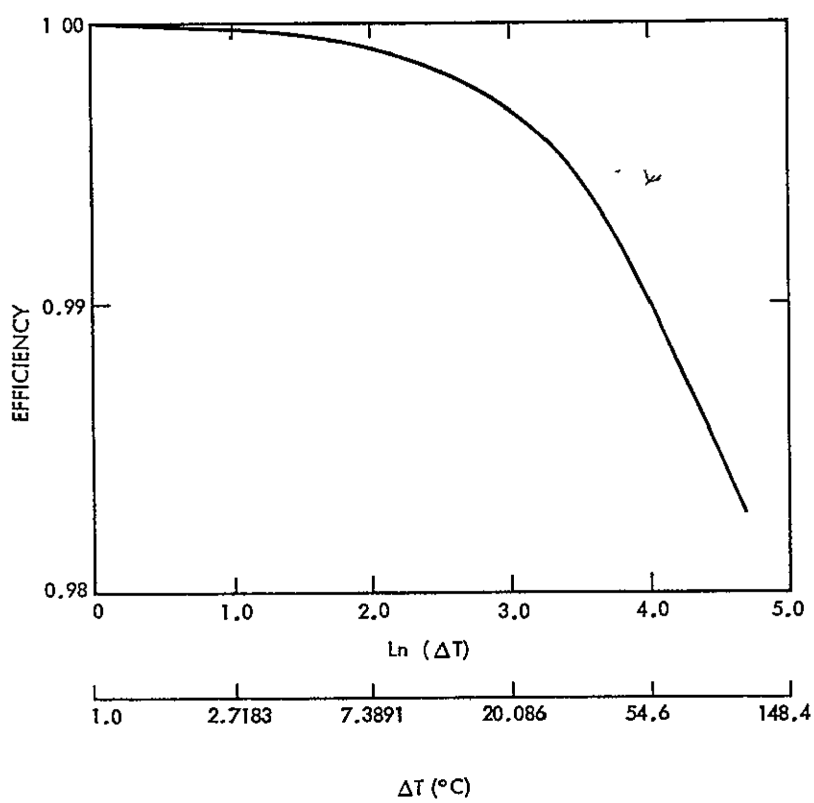


Figure B23. Non-Dimensional Efficiency - Thermal Effects

5. Governing Equations and Solutions for the Membrane

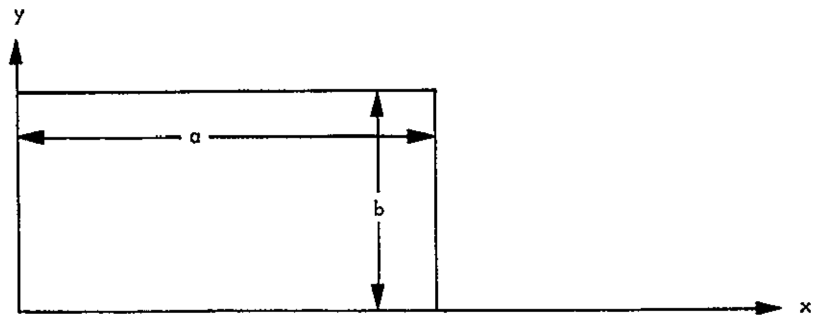


Figure B24. Membrane Schematic

The well-known Von Karman large deflection plate equation will be used.

$$D \nabla^2\nabla^2 w = q + \frac{\partial^2 F}{\partial y^2}\frac{\partial^2 w}{\partial x^2} - 2\frac{\partial^2 F}{\partial x \partial y}\frac{\partial^2 w}{\partial x \partial y} + \frac{\partial^2 F}{\partial x^2}\frac{\partial^2 w}{\partial y^2} \tag{B61}$$

$$\nabla^2\nabla^2 F = Eh\left[\left(\frac{\partial^2 w}{\partial x \partial y}\right)^2 - \frac{\partial^2 w}{\partial x^2}\frac{\partial^2 w}{\partial y^2}\right] \tag{B62}$$

where

$$\nabla^2 = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} = \text{Harmonic operator} \tag{B63}$$

w = deflection in z-direction (normal to the membrane surface)

E = Modulus of elasticity

h = Membrane thickness

q = External loading normal to the surface

F = Stress function defined as

$$N_x = \frac{\partial^2 F}{\partial y^2}\ , \quad N_y = \frac{\partial^2 F}{\partial x^2}\ , \quad N_{xy} = -\frac{\partial^2 F}{\partial x \partial y}$$

N_x, N_y, N_{xy} are the in-plane stresses in the x, y directions and the in-plane shear stress, respectively.

$$D = \frac{Eh^3}{12\ (1-\nu^2)} = \text{bending rigidity where } \nu \text{ is the Poisson's ratio.}$$

Because of the thinness of the membrane, it will be assumed that $D \cong 0$.

Equations (B61) and (B62) are nonlinear in nature; therefore, only the approximate solutions will be sought. The Galerkin's procedure will be used to obtain the approximate solution. Let

$$w(x,y) = A \sin\left(\frac{\pi x}{a}\right) \sin\left(\frac{\pi y}{b}\right) \tag{B64}$$

Note: Equation (B64) satisfies the boundary conditions.

Substituting Equation (B64) into Equation (B62), one obtains

$$F(x,y) = \alpha \cos\left(\frac{2\pi x}{a}\right) + \beta \cos\left(\frac{2\pi y}{b}\right) \tag{B65}$$

where

$$\alpha = \frac{Eh}{32}\ \frac{a^2}{b^2}\ A^2 \quad , \quad \beta = \frac{Eh}{32}\ \frac{b^2}{a^2}\ A^2 \tag{B66}$$

Next, substituting Equations (B64) and (B65) into Equation (B61), one obtains:

$$q + \frac{4\pi^2}{a^2 b^2}\left[\alpha \cos\left(\frac{2\pi x}{a}\right) + \beta \cos\left(\frac{2\pi y}{b}\right)\right] A \sin\left(\frac{\pi a}{a}\right) \sin\left(\frac{\pi y}{b}\right) = 0 \tag{B67}$$

Equation (B67) will be multiplied by a weighting function which will be

$$\frac{\partial w}{\partial A} = \sin\left(\frac{\pi a}{a}\right) \sin\left(\frac{\pi y}{b}\right) \tag{B68}$$

and integrated over the entire surface.

The resulting equation is

$$\frac{4qb^4}{\pi^4} = \frac{4\pi^4}{8}\ (b/a)^2\ (\alpha+\beta)\ A \tag{B69}$$

Let

$$A = W_0 \cdot h, \text{ and}$$

$$\gamma = \frac{b}{a} = \text{aspect ratio} \text{ , then}$$

$$w_0 = 0.643 \left(\frac{1}{\gamma^4+1} \; \frac{qb^4}{Eh^4} \right)^{1/3} \tag{B70}$$

6. Solutions for Initial Imperfection (Manufacturing Defects)

Let

$$w(x,y) = w_0(x,y) + \overline{w}(x,y) \tag{B71}$$

where w_0 is the initial imperfection, and $\overline{w}$ is the deformation due to external loads. Let

$$w_0(x,y) = \sum_{m=1}^{\infty} \sum_{n=1}^{\infty} (A_0)_{mn} \sin\left(\frac{m\pi x}{a}\right) \sin\left(\frac{n\pi y}{b}\right) \tag{B72}$$

$$\overline{w}(x,y) = A \sin\left(\frac{\pi x}{a}\right) \sin\left(\frac{\pi y}{b}\right) \tag{B73}$$

Equation (B72) assumes that the initial imperfection can be expanded into a double Fourier series. In view of the deflection shape as expressed by Equation (B73) and because of the orthogonality condition, the dominating term in the initial imperfection series will be the one with $m = n = 1$.

Therefore, let

$$w_0(x,y) \cong A_0 \sin\left(\frac{\pi a}{a}\right) \sin\left(\frac{\pi y}{b}\right) \tag{B74}$$

Upon substitution of Equations (B73) and (B74) into (B62), the stress function can be obtained as

$$F(x,y) = \overline{\alpha} \cos\left(\frac{2\pi x}{a}\right) + \overline{\beta} \cos\left(\frac{2\pi y}{b}\right) \tag{B75}$$

where

$$\overline{\alpha} = \frac{Eh}{32}\frac{a^2}{b^2}(A_0+A) \quad , \quad \overline{\beta} = \frac{Eh}{32}\frac{b^2}{a^2}(A_0+A) \tag{B76}$$

Using Galerkins procedure as described previously, one obtains

$$A^3 + 3A_0A^2 + 2A_0A - 0.2663\,\frac{1}{\gamma^4+1}\frac{qb^4}{Eh} = 0 \tag{B77}$$

Let

$$X = \frac{1}{h}(A+A_0)$$

then

$$X^3 - \left(\frac{A_0}{h}\right)^2 X - \frac{0.2663}{\gamma^4+1}\frac{qb^4}{Eh^4} = 0 \tag{B78}$$

7. One Dimensional Membrane (String for Global Effect)

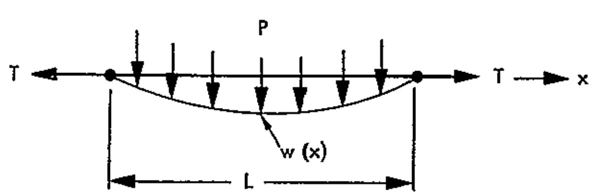


Figure 25. String Schematic

$$T\frac{d^2w}{dx^2} = p \tag{B79}$$

$$w = -\frac{1}{2}\frac{p}{T}x^2 + c_1x + c_2 \tag{B80}$$

Boundary Conditions:

$$w = 0 \text{ at } x = 0, L$$

$$c_1 = \frac{1}{2}\frac{pL}{T} \quad , \quad c_2 = 0 \tag{B81}$$

$$w(x) = \frac{px}{2T}(L-x)$$

APPENDIX B

SECTION III

BLANKET OUT-OF-FLATNESS DUE TO BOOM THERMAL DISTORTION

APPENDIX B

SECTION III

BLANKET OUT-OF-FLATNESS DUE TO BOOM THERMAL DISTORTION

An estimate of the effect of boom longeron differential temperature on blanket out-of-flatness will be made.

Assume that the boom can be represented by a cantilevered beam as follows:

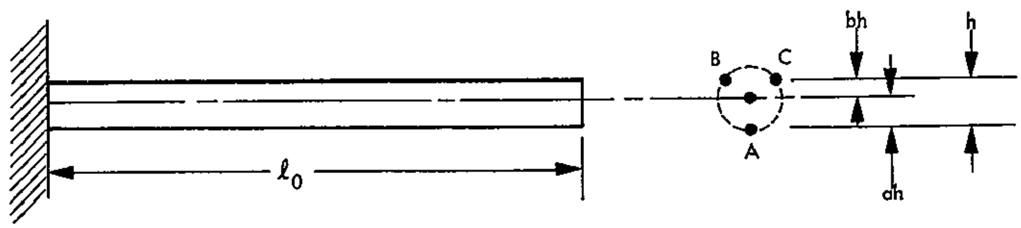


Figure B26. Undeformed Lattice Boom

Let the length of the beam along the neutral axis at some nominal temperature T_0 be ℓ_0.

Assume that longerons B and C are at a uniform higher temperature and longeron A is at a lower temperature and that the temperature difference is at ΔT. The boom will then assume a shape as shown in Figures B27 and B28.

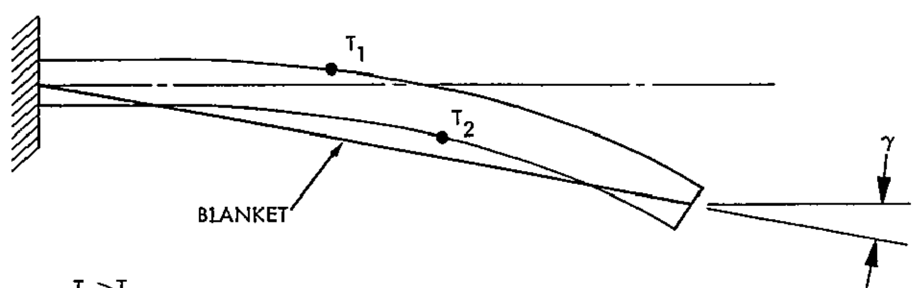


Figure B27. Deformed Lattice Boom

Let r be the radius of the beam at the neutral axis and γ be the angle the blanket deflects from the undeformed position.

It is assumed that the blanket tension acts along the neutral axis of the beam

$$\ell_0 = r\theta \tag{B82}$$

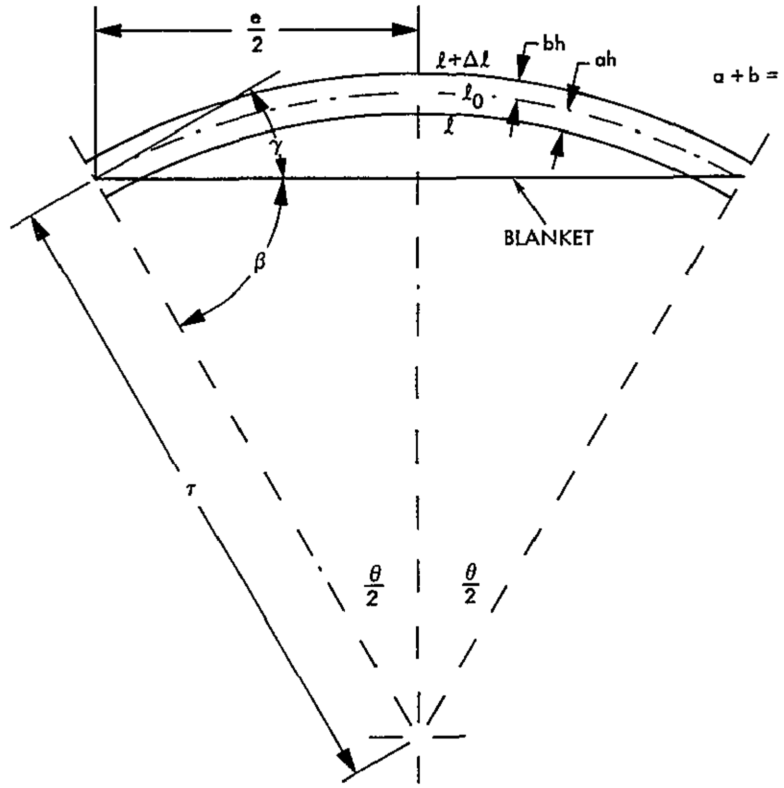


Figure B28. Geometry of Deformed Boom

$$\ell = (r-ah)\ \theta \tag{B83}$$

$$\ell + \Delta\ell = (r+bh)\ \theta \tag{B84}$$

from (B83) and (B84)

$$r = \frac{(\ell + a\Delta\ell)h}{\Delta\ell} \tag{B85}$$

$$\theta = \frac{\Delta\ell\ \ell_0}{(\ell + a\Delta\ell)\ h} \tag{B86}$$

$$\begin{aligned} \Delta\ell &= \alpha\ \ell\ \Delta T \\ \Delta\ell &\approx \alpha\ \ell_0\ \Delta T \end{aligned} \tag{B87}$$

$$\gamma = \frac{\theta}{2} = \frac{\Delta\ell\ \ell_0}{2(\ell + a\Delta\ell)\ h} \tag{B88}$$

or since

$$0 < a < 1 \quad - \quad \ell + a\Delta\ell \approx \ell_0$$

$$\gamma = \frac{\Delta\ell}{2h} = \frac{\alpha\ \ell_0\ \Delta T}{2h} \tag{B89}$$

Equation (B89) relates the angular displacement of the blanket to the differential temperature of the boom for an unloaded blanket. Since the boom is subjected to a load from the total blanket tension F_{BT}, the shear load F_S on the boom is

$$F_S = F_{BT} \sin \gamma \tag{B90}$$

or for small γ

$$F_S \approx F_{BT}\ \gamma \tag{B91}$$

and the additional angle introduced by beam deflection can be derived from the force deflection characteristics for the out-of-plane boom/blanket combination

$$f = \left(\frac{3EI}{\ell_0^3} - \frac{F_{BT}}{8\ell_0} \right) u \tag{B92}$$

where F_{BT} is the total blanket tension and EI define the boom stiffness

$$u = \frac{8\ \ell_0^3}{24EI - F_{BT}\ \ell_0^2}\ f \tag{B93}$$

$$\gamma' = \frac{u}{\ell_0} = \frac{8\ \ell_0^2\ \gamma\ F_{BT}}{24EI - F_{BT}\ \ell_0^2} \tag{B94}$$

ORIGINAL PAGE IS
OF POOR QUALITY

$$\gamma' = \frac{8\gamma}{24\ \dfrac{EI}{F_{BT}\ \ell_0^2} - 1} \tag{B95}$$

introduce

$$P_{cr} = \frac{\pi^2 EI}{\ell_0^2} \tag{B96}$$

and

$$\frac{F_{BT}}{P_{cr}} = \eta \tag{B97}$$

$$\gamma' = \frac{8\gamma}{\frac{24}{\pi^2 \eta} - 1} = \frac{\gamma\eta}{0.304 - 0.125\,\eta} \tag{B98}$$

the total blanket deflection due to thermal deformation is then

$$\gamma_T = \gamma + \gamma' = \left(1 + \frac{\eta}{0.304 - 0.125\,\eta}\right)\gamma \tag{B99}$$

$$\gamma_T = \left(\frac{0.304 + 0.875\,\eta}{0.304 - 0.125\,\eta}\right)\frac{\alpha\,\ell_0\,\Delta T}{2h} \tag{B100}$$

For coilable lattice booms

$$h = \frac{2}{3} R \tag{B101}$$

$$\gamma_T = \left(\frac{0.304 + 0.875\,\eta}{0.304 - 0.125\,\eta}\right)\frac{\alpha\,\ell_0\,\Delta T}{3R} \tag{B102}$$

and the power loss

$$\mathcal{E} = 1 - \cos\gamma_T \tag{B103}$$

The above derivation neglects any out-of-plane stiffness due to the cant angle and is hence conservative giving what is believed to be an upper bound on γ_T and $\mathcal{E}$ for the GE rollout conceptual design. The LMSC foldout concept has an

eccentric loading on the mast. The above derivation should again give a conservative estimate since the thermal distortion, which is much smaller than that for the GE boom, tends to compensate for the boom eccentric loading. Figure B29 shows the variation in degrees as a function of the dimensionless parameter $\alpha \ell_0 \Delta T/3R$ for typical values of interest.

$0.2 \leq \eta \leq 1.0$

$\alpha = 2.9 \times 10^{-6}$ in./in./°C

$1°C \leq \Delta T \leq 30°C$

$50 \leq \frac{\ell_0}{R} \leq 500$

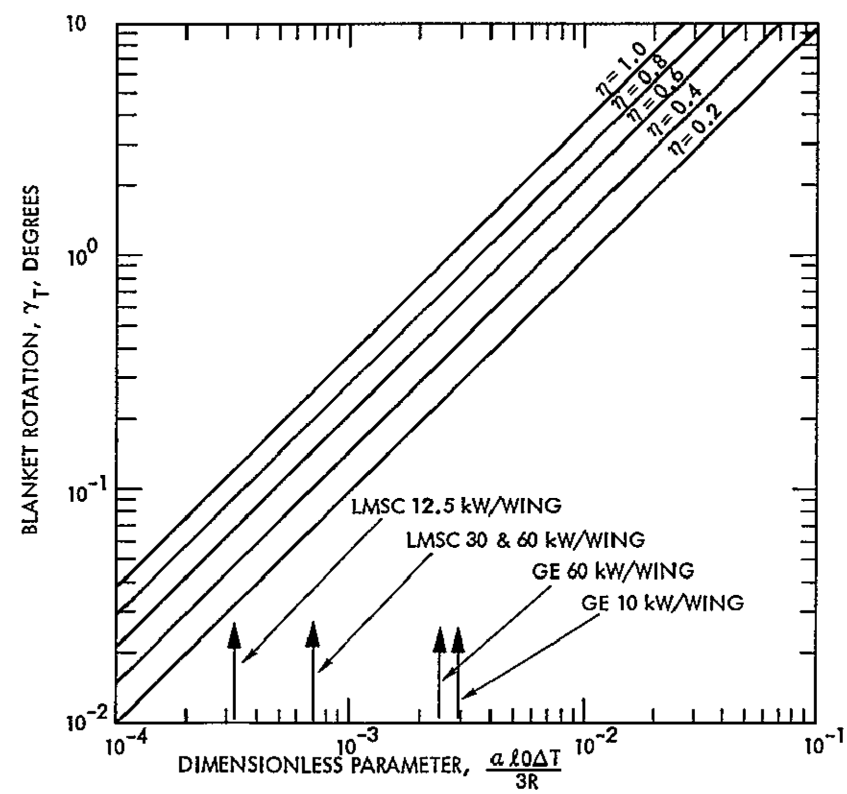


Figure B29. Blanket Rotation due to Boom Thermal Distortions

APPLICATION TO EXISTING DESIGNS

1. GE Rollout Design

10 kw/wing

$EI = 1.854 \times 10^5$ lb-in.^{2}

$\ell = 677$ in.

$\Delta T = 11°C$

$R = 2.5$ in.

Load $= 2F_D = 3.2$ lb

$P_{cr} = 4.0$

$\eta = 0.8$

$$\frac{\alpha\ \ell_0\ \Delta T}{3R} = 2.88 \times 10^{-3}$$

$\gamma_T = 1.42 \times 10^{-2}$ rad $= 0.81$ deg

$\mathcal{E} = 1.0 \times 10^{-4}$

60 kw/wing

$EI = 52 \times 10^6$ lb-in.^{2}

$\ell = 2382$ in.

$\Delta T = 11°C$

$R = 10$ in.

$\text{Load} = 2F_D = 55.2 \text{ lb}$

$P_{cr} = 90.45$

$\eta = 0.61$

$\dfrac{\alpha \, \ell_0 \, \Delta T}{3R} = 2.42 \times 10^{-3}$

$\gamma_T = 8.90 \times 10^{-3} \text{ rad} = 0.51 \text{ deg}$

$\varepsilon = 4.0 \times 10^{-5}$

2. LMSC Foldout Design

<u>12.5 kw/wing</u>

$EI = 22 \times 10^6 \text{ lb/in.}^2$

$\ell = 1244 \text{ in.}$

$\Delta T = 6°C$

$R = 7.5 \text{ in.}$

$\text{Load} = 22 \text{ lb}$

$P_{cr} = 140.3 \text{ lb}$

$\eta = 0.16$

$\dfrac{\alpha \, \ell_0 \, \Delta T}{3R} = 9.63 \times 10^{-4}$

$\gamma_T = 1.50 \times 10^{-3}$ rad = 0.09 deg

$E = 1.2 \times 10^{-6}$

30 kw/wing

$EI = 1.52 \times 10^{6}$ lb-in.^{2}

$\ell = 1257$ in.

$\Delta T = 6°C$

$R = 3.5$ in.

Load = 3 lb

$P_{cr} = 9.5$ lb

$\eta = 0.32$

$$\frac{\alpha\, \ell_0\, \Delta T}{3R} = 2.08 \times 10^{-3}$$

$\gamma_T = 4.59 \times 10^{-3}$ rad = 0.27 deg

$E = 1.1 \times 10^{-5}$

60 kw/wing

$EI = 9.95 \times 10^{6}$ lb-in.^{2}

$\ell = 2000$ in.

$\Delta T = 6°C$

$R = 5.5$ in.

Load $= 5$ lb

$P_{cr} = 24.3$ lb

$\eta = 0.21$

$$\frac{\alpha \ \ell_0 \ \Delta T}{3R} = 2.12 \times 10^{-3}$$

$\gamma_T = 3.72 \times 10^{-3}$ rad $= 0.21$ deg

$E = 6.7 \times 10^{-6}$

APPENDIX C

THERMAL ANALYSES

CONTENTS

APPENDIX C

THERMAL ANALYSES

The thermal analyses performed in support of this study were aimed at providing temperature level and distribution of the extensible array boom elements and of the solar array cell blankets. While the current study focuses on array performance at a heliocentric distance of 1 AU, the thermal studies were extended to cover 0.3 to 0.5 AU.

I. THERMAL ANALYSES OF THE EXTENSIBLE BOOMS

1. Boom Temperature Level as a Function of Heliocentric Distance for the LMSC Foldout Solar Array

In the LMSC solar array design, the extensible boom is shaded from the sun by the solar cell blanket as shown in Figure C1. So, the boom's primary thermal radiative couplings are with the anti-sun side of the solar array and cold, black space. Furthermore, since any given mast element (e.g., longeron, batten, etc.) is physically close to the very large solar array, its geometric form factor to the array is, to first order, 1/2. Consequently, if end effects are ignored, only minor temperature deviations between elements would be expected. For these conditions, the energy balance for element i becomes:

$$\mathscr{F}_{i,a} \left(T_a^{\,4} - T_i^{\,4}\right) = \mathscr{F}_{i,s} T_i^{\,4} \tag{C1}$$

where

- T - absolute temperature
- $\mathscr{F}$ - Hottel script-F
- F - form factor
- ε - emittance

and subscripts

- a - array substrate (anti-sun side of solar cell blanket)
- i - mast element
- s - space

Noting that

$$\varepsilon_i = \mathscr{F}_{i,i} + \mathscr{F}_{i,a} + \mathscr{F}_{i,s}, \quad \text{where} \quad \mathscr{F}_{i,i} \approx 0 \quad (\text{since } F_{i,i} = 0)$$

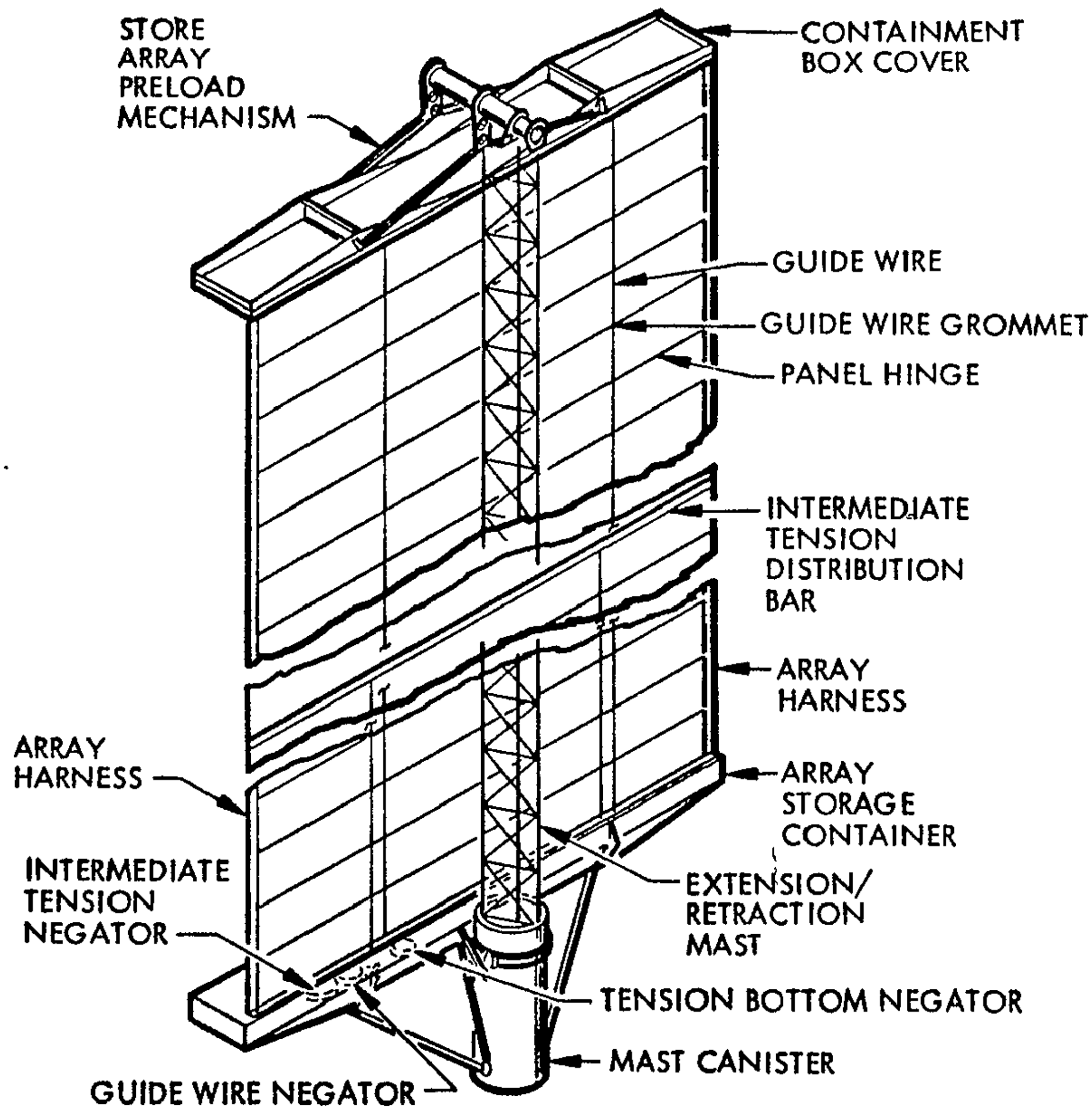


Figure C1. LMSC Foldout Array

and

$$\mathscr{F}_{i,a} \approx \varepsilon_i \varepsilon_a F_{i,a} = \varepsilon_i \varepsilon_a (1/2),$$

Equation (C1) reduces to

$$T_i^{\,4} = \frac{\varepsilon_a}{2} T_a^{\,4} \tag{C2}$$

The LMSC solar cell is qualified only up to 140°C. This establishes the upper limit for T_a which will probably be achieved by off-sun rotation of the array at small heliocentric distances. Temperatures of the solar array substrate (made of Kapton with $\varepsilon_a = 0.74$) at 1 and 5 AU are about 46 and -131°C, respectively. With the aid of Equation (C2), the mast element temperature level is no greater than 49°C at small heliocentric distances, is -24°C at 1 AU, and drops to -162°C at 5 AU.

2. Boom Temperature Level as a Function of Heliocentric Distance for the GE Rollout Solar Array

A cursory thermal analysis indicated the advisability of covering the GE rollout array boom with a thermal sleeve to avoid significant temperature non-uniformity. The analysis assumes that such a sleeve will be used for the mast of the rollout concept.

SUMMARY

The thermal effect of covering the GE solar array mast with a 1 mil thick, aluminized Teflon sleeve for the purpose of avoiding significant temperature non-uniformity was investigated. It was concluded that temperature differences between mast longerons (which affect mast straightness) could be limited to 20°C or less over the heliocentric distance range of 0.3 to 5 AU. Much larger temperature differences could potentially occur if no sleeve were used.

a. Introduction. One of the concerns in the design of large scale, high power/low mass (flimsy) solar arrays is the potential for thermally induced distortion of the array deployment boom. To the extent that boom straightness determines the shape of the cell blanket, boom distortion results in loss of electrical power delivered by the array. From this point of view, temperature differences in the boom are undesirable.

A number of factors can produce temperature non-uniformities in the GE, V-stiffened rollup array boom (see Figure C2). First, the boom is exposed to direct solar irradiation. Consequently, spatial variations in surface radiation properties α and ε can lead to significant temperature non-uniformity - particularly at small heliocentric distances (e.g., 0.3 AU) where solar fluxes are extremely high. A second consideration is the sensitivity to geometric position of a mast longeron since this determines its "view" of cold, black space. It can be shown that such view factors to space can vary from about 0.5 to nearly 1 with relatively minor positional changes. Translated into thermal consequences, if for example $\alpha = 0.2$ and $\varepsilon = 0.85$, temperature differences between longerons may exceed 50°C at 0.3 AU due to this effect alone. The third and potentially most severe factor is partial solar shading of the mast which, at small heliocentric distances, can cause temperature differences exceeding 100°C.

In an attempt to arrive at a design modification which would reduce potential temperature differences between longerons, a proposal has been made to consider enclosing the mast in a cylindrical sleeve made of a 1 mil, aluminized Teflon film which could be deployed simultaneously with the solar cell blanket. This section documents the thermal analysis of that concept.

b. Analysis. Since the sleeve is a very thin plastic, circumferential conduction is negligible.* For the sake of simplification, the sleeve is assumed to have an unobscured view of space and its inside surface is assumed to have a high emittance coating. The sleeve then provides the radiative thermal environment which the longerons "see" and which determines their temperatures. Conversely, however, the longerons influence the sleeve temperature distribution in a negligible manner. Under these circumstances, the heat balance for the sleeve, shown in Figure C3, is given by

$$\alpha \frac{S_\oplus}{\delta^2} \max\,(\cos\theta, 0)\; dA + \int_\theta^{\theta+2\pi} \sigma \mathscr{F}_{dA,dA'}\, T^4(\theta')\; dA = (\varepsilon_o+\varepsilon_i)\,\sigma T^4(\theta)\; dA \qquad \text{(C3)}$$

where

- α - solar absorptance
- ε - emittance
- σ - Stefan-Boltzmann constant
- T - absolute temperature
- dA - differential surface area
- θ - angle
- $S_\oplus$ - extraterrestrial solar irradiance @ 1 AU
- δ - heliocentric distance
- $\mathscr{F}$ - Hottel script - F
- F - form factor
- i - inside surface } subscripts
- o - outside surface }

*The aluminum film, typically only 1000-2000 Å thick, does not provide a significant conductance in parallel with the Teflon.

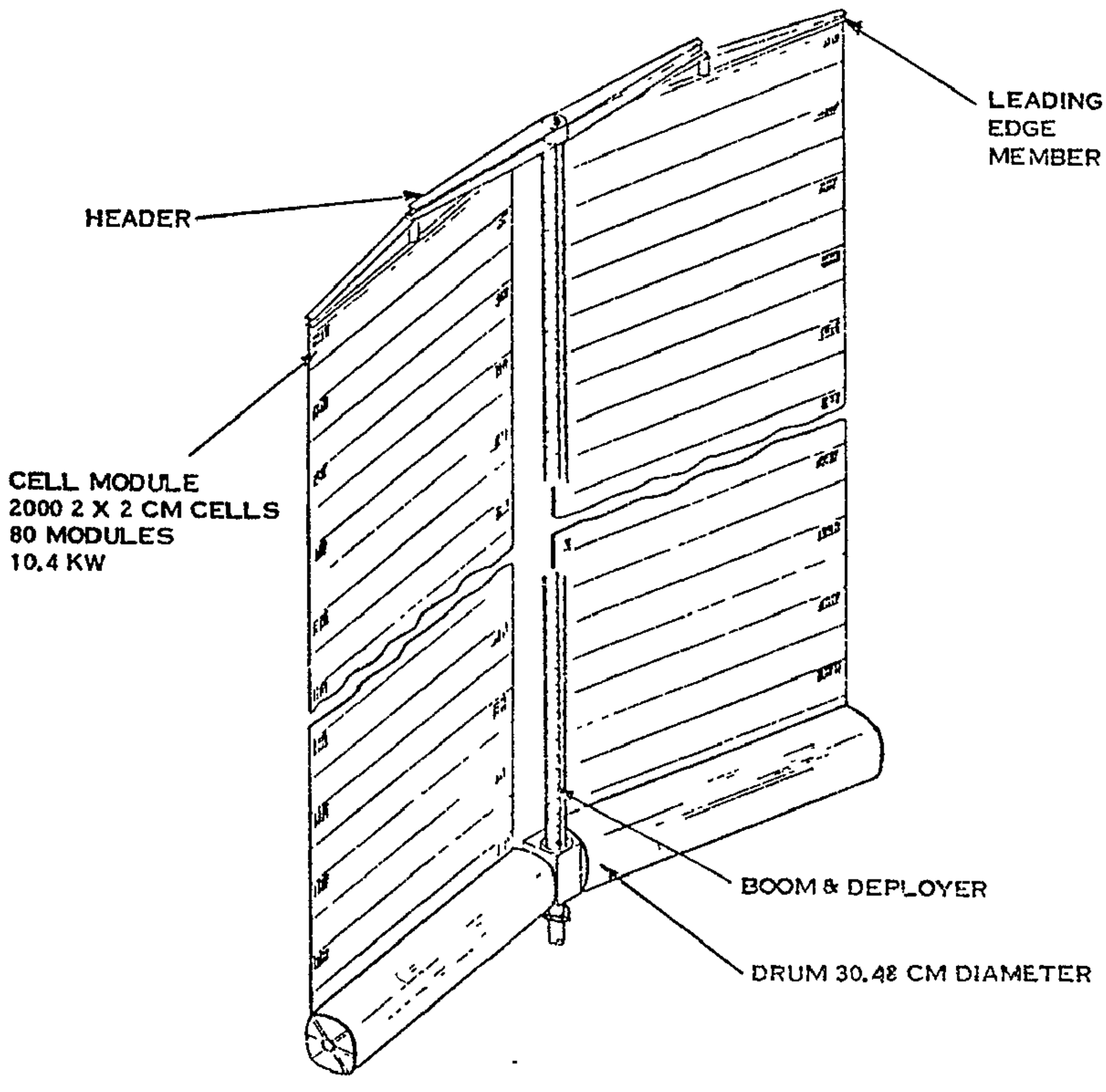


Figure C2. GE Rollout Array

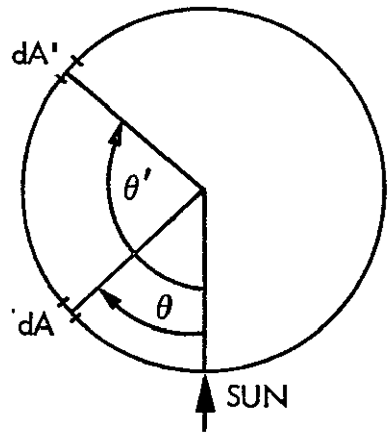


Figure C3.

Equation (C3) was solved by the method of Fourier Series (Reference 22). Note that the temperature distribution must be an even function of θ about θ = 0. Thus, it was assumed that

$$\max(\cos\theta, 0) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos(n\theta)$$

and

$$\sigma T^4(\theta) = \frac{b_o}{2} + \sum_{n=1}^{\infty} b_n \cos(n\theta)$$

Since $\varepsilon_i \approx 1$, it follows that $\mathscr{F}_{dA,dA'} = \varepsilon_i^2 F_{dA,dA'}$ and Hottell's crossed-strings technique can be used to deduce the form factor

$$F_{dA,dA'} = \frac{1}{4} \left| \sin\left(\frac{\theta-\theta'}{2}\right) d\theta' \right| .$$

When these relationships were introduced and the Fourier coefficients a_n and b_n were determined, the following temperature distribution resulted:

$$T^4(\theta) = \frac{\alpha S_\oplus}{\sigma\delta^2}\left\{\frac{1}{\pi}\left(\frac{1}{\varepsilon_o+\varepsilon_i-\varepsilon_i^2}\right) + \frac{1}{2}\left(\frac{1}{\varepsilon_o+\varepsilon_i+\varepsilon_i^2/3}\right)\cos\theta \right.$$

$$\left. + \sum_{m=1}^{\infty}\frac{2}{\pi}\left[\frac{-(-1)^m \cos(2m\theta)}{(4m^2-1)\left(\varepsilon_o+\varepsilon_i+\varepsilon_i^2/(16m^2-1)\right)}\right]\right\} \quad \text{(C4)}$$

where $m = 2n$.

With the aid of Equation (C4), the corresponding temperature T_l of a longeron whose center-line is at the point $(r/R, \phi)$ can be computed as follows:

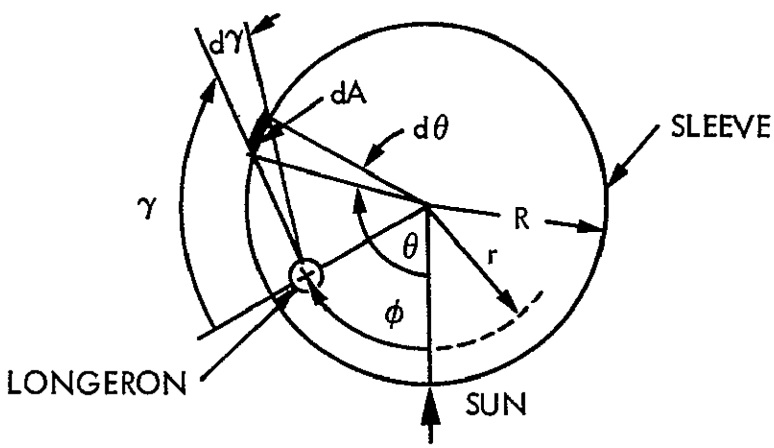


Figure C4.

Referring to Figure C4, the heat balance for the longeron is:

$$\int_{\gamma=0}^{\gamma=2\pi} \varepsilon_\ell \varepsilon_i \, dA \, F_{dA,A_\ell} \, \sigma\left[T^4(\theta) - T_\ell^{\,4}(r/R,\phi)\right] = 0 \quad \text{(C5)}$$

By reciprocity,

$$dA \; F_{dA,A_\ell} = A_\ell \; F_{A_\ell,dA}.$$

Using Hottel's method again, it can be shown that

$$F_{A_\ell, dA} = \frac{d\gamma}{2\pi}$$

Upon substitution, equation (C5) is simplified to

$$T_\ell = \left[\frac{1}{2\pi} \int_0^{2\pi} T^4(\theta)\, d\gamma \right]^{1/4} \tag{C6}$$

where θ and γ are related by

$$\frac{r}{R} \sin\gamma = \sin(\gamma - \theta + \phi). \tag{C7}$$

Equation (C6) was numerically integrated using equations (C4) and (C7) as a function of heliocentric distance assuming

$$\left.\begin{aligned} \alpha &= 0.16 \\ \varepsilon_o &= 0.52 \end{aligned}\right\} \begin{aligned} &\text{1 mil silvered Teflon.} \\ &\text{Teflon side out, worst case } \alpha/\varepsilon \end{aligned}$$

$$\varepsilon_i = 1$$

and $r/R = 0.95$.

The results, given in Table C-I below, relate to longerons placed at $\phi = \pm 60$ and $180°$ for which temperature differences are minimum* (less than half that for $\phi = 0$ and $\pm 120°$). The 20°C maximum temperature difference predicted is substantially less than that which could potentially occur without the sleeve in place. However, the analysis does not consider the effect of mast rotation required at heliocentric distances less than about 0.7 AU. While such rotation would tend to increase the longeron temperature differences, further study may show that a judicious choice of coating on the inner sleeve surface may more than compensate for this effect.

*For equal angular spacing.

Table C-I. Longeron Maximum Temperature Level and Difference as a Function of Heliocentric Distance

Heliocentric Distance (AU)	Longeron Arithmetic Mean Temperature Level (C°)	Longeron Maximum Temperature Difference (°C)
0.3	128.6	20.0
0.4	74.8	17.2
0.5	38.1	15.4
0.6	10.9	14.1
0.7	-10.1	13.0
0.8	-27.2	12.2
0.9	-41.2	11.5
1.0	-53.1	10.9
2.0	-117.5	7.7
3.0	-146.1	6.3
4.0	-163.1	5.5
5.0	-174.7	4.9

c. Conclusions. Temperature differences between mast longerons in the GE, V-stiffened rollup solar array configuration can be limited to 20°C or less over a heliocentric distance range of 0.3 to 5 AU by the use of a 1 mil aluminized Teflon sleeve which covers the mast.

II. THERMAL ANALYSES OF THE SOLAR ARRAY BLANKETS

This section deals with the solar cell blanket temperature level as related to thermal control and deviation resulting from non-flatness. It also discusses blanket non-uniformities in the GE rollout array induced solely by the V-stiffened geometry.

1. Solar Cell Blanket Temperature Control, Level, and Deviation Resulting from Non-Flatness

a. Analysis. The quasi-equilibrium temperature of an LMSC solar cell blanket or GE half blanket is given by solution of its energy balance equation

$$(\alpha - f\eta) \frac{S_\oplus}{\delta^2} \cos\theta = \sigma(\varepsilon_a + \varepsilon_b) T^4 \qquad \text{(C8)}$$

for the variable T where

$$\eta = \eta_o \left[1 + \beta(T - T_o)\right] \qquad \text{(C9)}$$

and

α - solar absorptance
ε - emittance
η - cell conversion efficiency at maximum power point
β - cell temperature coefficient
T - absolute temperature
f - cell packing factor
$S_\oplus$ - extraterrestrial solar irradiance @ 1 AU
δ - heliocentric distance
θ - cell blanket local solar angle of incidence
σ - Stefan-Boltzmann constant

subscripts:

a - front (i.e., solar illuminated) side
b - back side
o - reference (T_o = 28°C)

b. Cell Blanket Temperature Control. Of particular significant in this study is the solar angle of incidence θ on which the value of T is dependent. According to current strategy, θ is nominally maintained at zero for the LMSC cell blanket or $\pm\gamma$ (the V-stiffening angle) for the GE half blankets. However, as heliocentric distance decreases, blanket temperature increases and, at some critical distance δ_c, the blanket temperature reaches its design limit. In order not to exceed this temperature for further heliocentric distance decreases, the array is rotated about its mast axis off-sun by an angle θ_r, where

$$\theta_r = \theta = \cos^{-1} (\delta/\delta_c)^2 \text{ for LMSC} \tag{C10}$$

$$\theta_r = \gamma + \theta = \gamma + \cos^{-1} [(\delta/\delta_c)^2 \cos\gamma] \text{ for GE} \tag{C11}$$

for $\delta > \delta_c$.

With respect to the LMSC array, the rotation of equation (C10) produces a simple result. The cell blanket merely remains at a fixed temperature as the heliocentric distance decreases. However, two very important points must be addressed relative to the GE array. First, because of the V-stiffened design, any array rotation leads to unequal solar angles of incidence of the two half blankets and, thus, temperature level differences between them. Since electrical characteristics of solar cells are temperature dependent, the result is an electrical mismatch between the half blankets. The second and perhaps most serious concern is one of a potential for instability in array rotation in the neighborhood of δ_c. It is clear that for $\delta \leq \delta_c$, $\theta_r = 0$. However, at the instant that δ exceeds δ_c by an infinitesimal amount, equation (C11) shows that $\theta_r = 2\gamma$. Depending upon the sense of rotation, one of the half blanket temperatures increases, reaching

a maximum at $\theta_r = \gamma$ before returning to its value before rotation at $\theta_r = 2\gamma$ (the other half blanket temperature strictly decreases with θ_r). If the θ_r control logic were based solely on the output of a blanket temperature transducer, the array might be driven into mechanical fibrillation.

c. Cell Blanket Temperature Deviations. Because the LMSC cell blankets, or GE half blankets, cannot be made perfectly flat, there will be spatial variations of the solar angle of incidence resulting in spatial temperature deviations.

d. Results. The data in Tables C-II through C-IV were generated using equations (C8) through (C11) for the following parameter values:

Parameter	LMSC	GE
α	0.77	0.84
ε_a	0.81	0.71
ε_b	0.74	0.74
f	0.9	0.9
η	11.4%	12%
T_o	301.15K (28°C)	301.15K (28°C)
β	-0.005/°C	-0.0033/°C
γ	Not Applicable	3° or 8°

Required angle of rotation θ_r, cell blanket temperature T, and temperature deviations $\Delta T^+ \equiv T(\theta+\Delta\theta) - T(\theta)$ and $\Delta T^- \equiv T(\theta-\Delta\theta) - T(\theta)$ are given as a function of heliocentric distance δ. These data show that temperature deviations are less than 4°C for $\delta < \delta_c$, even for $\Delta\theta = \pm 10°$. But, when array rotation is performed, $|\Delta T^+|$ and $|\Delta T^-|$ increase drastically as θ_r increases unless the blankets are almost perfectly flat. Indeed, even with perfectly flat blankets, Table C-IV shows that the GE V-stiffened array with $\gamma = 8°$ cannot provide any electrical power at 0.3 AU since the θ_r required to limit the cell temperature to 120°C on the temperature limited half blanket would cause one half blanket to shade the other and no cells would be illuminated.

e. Conclusions. For missions with $\delta \leq \delta_c$, blanket flatness requirements are not severe. But, for missions during which $\delta < \delta_c$, flatness becomes increasingly important as δ decreases if large temperature deviations are to be avoided.

Table C-II. Lockheed Foldout Array Temperatures

			ΔT^+ / ΔT^- (°C)					
			$\Delta\theta$ (deg)					
δ (AU)	θ_r (deg)	T (°C)	.1	.5	1	2	5	10
.3	76.41	140.00	-.81 .80	-4.08 3.97	-8.28 7.83	-17.07 15.26	-47.38 35.52	-122.38 64.09
.4	65.31	140.00	-.42 .42	-2.13 2.10	-4.31 4.16	- 8.77 8.17	-23.23 19.46	- 51.58 36.04
.5	49.26	140.00	-.23 .23	-1.14 1.12	-2.29 2.22	- 4.65 4.38	-12.17 10.49	- 26.30 19.52
.6	19.97	140.00	-.07 .07	- .36 .35	- .73 .69	- 1.49 1.34	- 4.00 3.07	- 8.98 5.25
.7	0	113.49	0.00 0.00	0.00 0.00	- .02 - .02	- .06 - .06	- .40 - .40	- 1.59 - 1.59
.8	0	86.77	0.00 0.00	0.00 0.00	- .01 - .01	- .06 - .06	- .37 - .37	- 1.47 - 1.47
.9	0	64.80	0.00 0.00	0.00 0.00	- .01 - .01	- .05 - .05	- .34 - .34	- 1.38 - 1.38
1	0	46.35	0.00 0.00	0.00 0.00	- .01 - .01	- .05 - .05	- .32 - .32	- 1.30 - 1.30
2	0	- 48.02	0.00 0.00	0.00 0.00	- .01 - .01	- .03 - .03	- .21 - .21	- .86 - .86
3	0	- 89.33	0.00 0.00	0.00 0.00	- .01 - .01	- .03 - .03	- .18 - .18	- .70 - .70
4	0	-113.96	0.00 0.00	0.00 0.00	- .01 - .01	- .02 - .02	- .15 - .15	- .61 - .61
5	0	-130.76	0.00 0.00	0.00 0.00	- .01 - .01	- .02 - .02	- .14 - .14	- .54 - .54

Table C-III(a). GE Rollout Array ($\gamma=3°$) -Temperature Limited Half Blanket Temperatures

δ (AU)	θ_r (deg)	T (°C)	ΔT+ / ΔT− (°C) Δθ (deg) .1	 .5	 1	 2	 5	 10
.3	83.16	120.00	-1.04 1.03	-5.29 5.09	-10.79 10.00	-22.53 19.32	Shaded	
.4	75.32	120.00	- .57 .56	-2.85 2.79	- 5.77 5.52	-11.83 10.80	-32.01 25.41	-75.81 46.42
.5	64.67	120.00	- .33 .33	-1.68 1.65	- 3.39 3.28	- 6.90 6.46	-18.18 15.40	-40.10 28.60
.6	49.90	120.00	- .19 .19	- .97 .95	- 1.95 1.89	- 3.96 3.73	-10.36 8.92	-22.39 16.56
.7	24.56	120.00	- .07 .07	- .36 .35	- .73 .69	- 1.49 1.35	- 3.99 3.12	- 8.91 5.40
.8	0	100.35	.01 - .01	.04 - .05	.07 - .10	.12 - .24	.07 - .82	- .60 - 2.39
.9	0	78.00	.01 - .01	.04 - .05	.07 - .10	.11 - .22	.07 - .77	- .56 - 2.25
1	0	59.29	.01 - .01	.04 - .04	.07 - .09	.11 - .21	.07 - .73	- .53 - 2.12
2	0	- 38.97	.01 - .01	.02 - .03	.04 - .06	.07 - .14	.04 - .49	- .36 - 1.44
3	0	- 81.94	0 0	.02 - .02	.04 - .05	.06 - .12	.04 - .40	- .29 - 1.17
4	0	-107.56	0 0	.02 - .02	.03 - .04	.05 - .10	.03 - .35	- .25 - 1.01
5	0	-125.04	0 0	.02 - .02	.03 - .04	.05 - .09	.03 - .31	- .23 - .91

Table C-III(b). GE Array (γ=3°) - Other Half Blanket Temperatures

δ (AU)	θ_r (deg)	T (°C)	ΔT^+ / ΔT^- (°C), Δθ (deg) .1	.5	1	2	5	10
.3	83.16	34.72	-2.10 2.06	-10.79 9.94	-22.60 19.07	-51.97 35.43	Shaded	Shaded
.4	75.32	80.44	- .78 .78	- 3.96 3.83	- 8.06 7.55	-16.71 14.65	-47.49 33.79	-136.85 60.29
.5	64.67	97.77	- .41 .41	- 2.08 2.04	- 4.20 4.04	- 8.57 7.94	-22.84 18.84	- 51.74 34.74
.6	49.90	107.38	- .23 .23	- 1.16 1.14	- 2.33 2.26	- 4.74 4.46	-12.40 10.67	- 26.92 19.86
.7	24.56	115.10	- .09 .09	- .47 .46	- .94 .91	- 1.93 1.78	- 5.10 4.17	- 11.20 7.47
.8	0	100.35	- .01 .01	- .05 .04	- .10 .07	- .24 .12	- .82 .07	- 2.39 - .60
.9	0	78.06	- .01 .01	- .05 .04	- .10 .07	- .22 .11	- .77 .07	- 2.25 - .56
1	0	59.29	- .01 .01	- .04 .04	- .09 .07	- .21 .11	- .73 .07	- 2.12 - .53
2	0	- 38.97	- .01 .01	- .03 .02	- .06 .04	- .14 .07	- .49 .04	- 1.44 - .36
3	0	- 81.94	0 0	- .02 .02	- .05 .04	- .12 .06	- .40 .04	- 1.17 - .29
4	0	-107.56	0 0	- .02 .02	- .04 .03	- .10 .05	- .35 .03	- 1.01 - .25
5	0	-125.04	0 0	- .02 .02	- .04 .03	- .09 .05	- .31 .03	- .91 - .23

Table C-IV(a). GE Rollout Array (γ=8°) - Temperature Limited Half Blanket Temperatures

δ (AU)	θ_r (deg)	T (°C)	ΔT^+ / ΔT^- (°C), Δθ (deg) = .1	.5	1	2	5	10
.3	Shaded							
.4	80.32	120.00	- .57 .56	- 2.85 2.79	- 5.77 5.52	Shaded		
.5	69.67	120.00	- .33 .33	- 1.68 1.65	- 3.39 3.28	- 6.90 6.46	-18.18 15.40	-40.10 28.60
.6	54.90	120.00	- .19 .19	- .97 .95	- 1.95 1.89	- 3.96 3.73	-10.36 8.92	-22.39 16.56
.7	29.56	120.00	- .07 .07	- .36 .35	- .73 .69	- 1.49 1.35	- 3.99 3.12	- 8.91 5.40
.8	0	99.53	.02 - .02	.12 - .12	.22 - .25	.42 - .54	.82 - 1.57	.89 - 3.92
.9	0	77.29	.02 - .02	.11 - .12	.21 - .24	.39 - .51	.77 - 1.48	.84 - 3.67
1	0	58.56	.02 - .02	.10 - .11	.20 - .23	.37 - .48	.73 - 1.39	.79 - 3.47
2	0	- 39.46	.01 - .01	.07 - .07	.13 - .15	.25 - .32	.49 - .94	.54 - 2.35
3	0	- 82.34	.01 - .01	.06 - .06	.11 - .12	.20 - .26	.40 - .77	.44 - 1.92
4	0	-107.90	.01 - .01	.05 - .05	.09 - .11	.18 - .23	.35 - .67	.38 - 1.66
5	0	-125.35	.01 - .01	.04 - .05	.08 - .10	.16 - .20	.31 - .60	.34 - 1.49

C-3

Table C-IV(b). GE Rollout Array (γ=8°) - Other Half Blanket Temperatures

δ (AU)	θ_r (deg)	T (°C)	ΔT+ ΔT− (°C) Δθ (deg) .1	.5	1	2	5	10
.3	Shaded							
.4	80.32	- 56.41	- 3.30 3.16	-18.32 14.58	-43.87 26.83	Shaded		
.5	69.67	46.03	- .66 .66	- 3.37 3.26	- 6.84 6.43	-14.16 12.50	-39.18 28.90	-108.84 51.74
.6	54.90	80.46	- .32 .31	- 1.59 1.56	- 3.20 3.09	- 6.51 6.09	-17.20 14.51	- 38.10 26.92
.7	29.56	103.90	- .13 .13	- .67 .66	- 1.35 1.30	- 2.73 2.56	- 7.17 6.10	- 15.54 11.20
.8	0	99.53	- .02 .02	- .12 .12	- .25 .22	- .54 .42	- 1.57 .82	- 3.92 .89
.9	0	77.29	- .02 .02	- .12 .11	- .24 .21	- .51 .39	- 1.48 .77	- 3.67 .84
1	0	58.56	- .02 .02	- .11 .10	- .23 .20	- .48 .37	- 1.39 .73	- 3.47 .79
2	0	- 39.46	- .01 .01	- .07 .07	- .15 .13	- .32 .25	- .94 .49	- 2.35 .54
3	0	- 82.34	- .01 .01	- .06 .06	- .12 .11	- .26 .20	- .77 .40	- 1.92 .44
4	0	-107.90	- .01 .01	- .05 .05	- .11 .09	- .23 .18	- - .67 .35	- 1.66 .38
5	0	-125.35	- .01 .01	- .05 .04	- .10 .08	- .20 .16	- .60 .31	- 1.49 .34

Special θ_r control logic must be provided with the GE array if during the missions $\delta < \delta_c$, otherwise mechanical instability may occur whenever $\delta \approx \delta_c$. In addition, the problem of half blanket electrical output mismatch must be addressed if $\delta < \delta_c$.

2. Solar Cell Blanket Temperature Non-Uniformities in GE Array Induced by V-Stiffened Geometry

SUMMARY

Temperature non-uniformities in the GE solar cell blanket induced solely by the V-stiffened geometry were found to be insignificant for design values of V-stiffening angle γ between 3 and 8 degrees of arc.

a. Introduction. 'Because a solar cell at (x_0, y_0), see Figure C5, has a larger geometric view factor to space than one at (x_1, y_1), it will tend to attain thermal quasi-equilibrium at a somewhat lower temperature. The magnitude of the temperature difference between the hottest and coldest cell is the subject of this section.

b. Analysis. The first step is to find the view factor to space from any cell -- a function of γ, A, B, x, and y. By inspection, the cell with the largest form factor to space is centered at x = 0 (or B) and y = A, and the cell with the smallest is centered at x = B/2 and y = 0*. By the use of "geometric flux algebra" and the closed form solution for a similar view factor, Reference 23, it can be deduced that for B >> A,

$$\max F_{c,s} = 1 - \frac{1}{4}\left\{1 - \left[\frac{1 - \cos(\pi - 2\gamma)}{2}\right]^{1/2}\right\}$$

$$\min F_{c,s} = \left[\frac{1 - \cos(\pi - 2\gamma)}{2}\right]$$

From the above relationships, the view factor from any cell to space $F_{c,s}$ is bounded by

$$\left.\begin{matrix} 0.9973 \\ 0.9806 \end{matrix}\right\} \leq F_{c,s} \leq \left\{\begin{matrix} 0.9997, & \gamma = 3^\circ \\ 0.9975, & \gamma = 8^\circ \end{matrix}\right.$$

*Cell dimensions are extremely small compared to A and B.

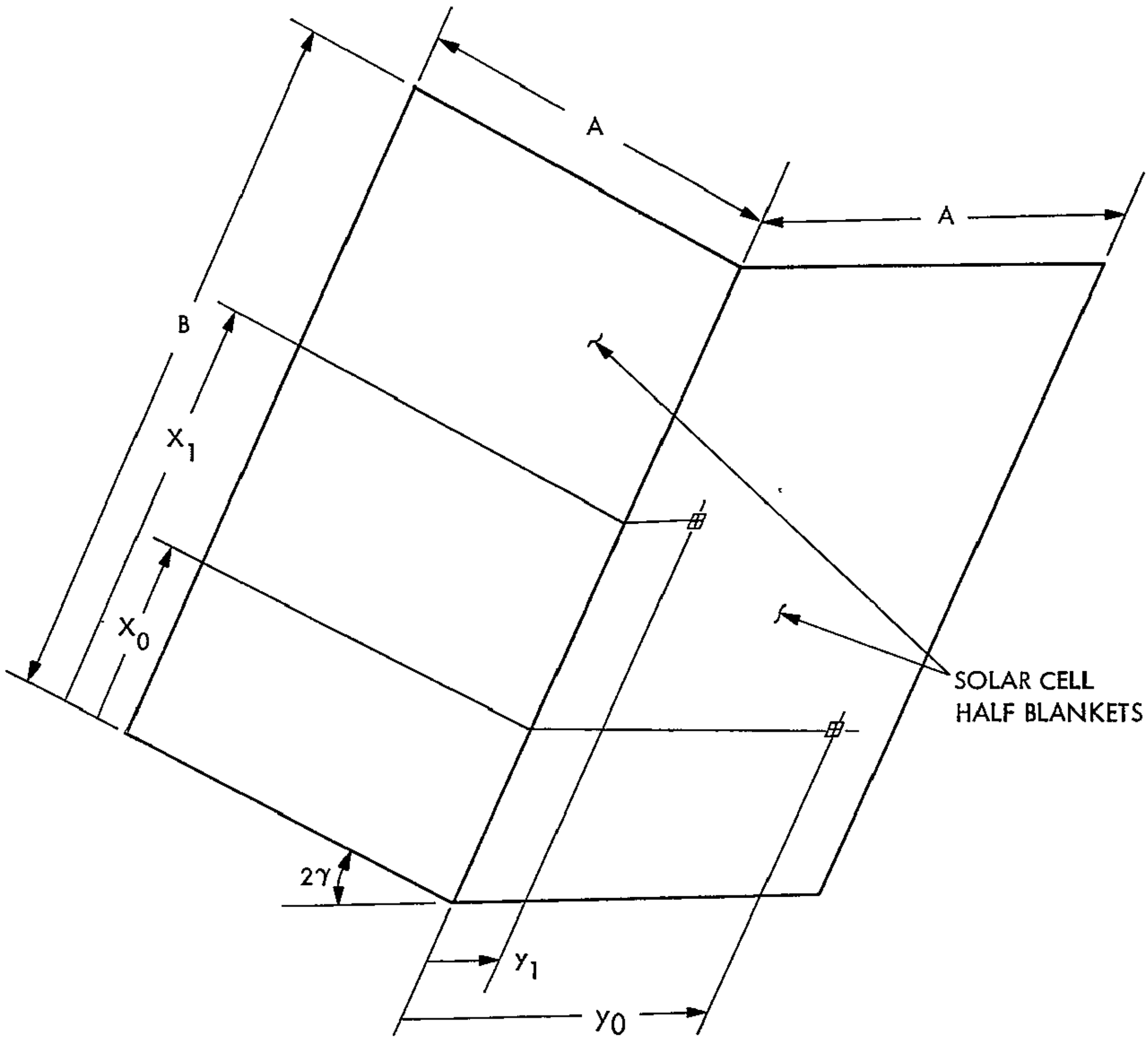


Figure C5. GE Rollout Array Basic Geometry

The heat balance for a cell, neglecting conductance paths between adjacent cells, is

$$(\alpha - f\eta) \frac{S_{\oplus}}{\delta^2 \sigma} \cos \gamma = (\varepsilon_b + \mathscr{F}_{c,h} + \mathscr{F}_{c,s}) T_c^4 - \mathscr{F}_{c,h} T_h^4 \qquad (C12)$$

where

- α - solar absorptance
- ε - emittance
- f - cell packing factor
- $\mathscr{F}$ - Hottel script-F
- F - view factor
- T - absolute temperature
- η - cell conversion efficiency
- $S_{\oplus}$ - extraterrestrial solar irradiance @ 1 AU
- δ - heliocentric distance in AU
- γ - V-stiffening angle
- σ - Stefan-Boltzmann constant

Subscripts:

- h - front face of half blanket which cell "sees"
- b - back face of half blanket
- c - cell, front face
- s - space

A similar heat balance, written for the half blanket to obtain its radiant average temperature T_h, is

$$(\alpha - f\eta) \frac{S_{\oplus} \cos \gamma}{\delta^2 \sigma} = (\varepsilon_b + \mathscr{F}_{h,s}) T_h^4 \qquad (C13)$$

It is easy to show that, consistent with our assumption that B >> A,

$$F_{h,s} = \cos \gamma. \qquad (C14)$$

Noting that $\varepsilon_s \equiv 1$ and $\varepsilon_h \approx \varepsilon_c \approx 1$ we can write

$$\mathscr{F}_{c,h} \approx \varepsilon_c^2 F_{c,h} = \varepsilon_c^2 (1 - F_{c,s}) \qquad (C15)$$

$$\mathscr{F}_{c,s} \approx \varepsilon_c F_{c,s} \quad , \tag{C16}$$

and

$$\mathscr{F}_{h,s} \approx \varepsilon_c \cos\gamma \tag{C17}$$

Equations (C12) through (C17) can be combined to yield the following expression:

$$T_c = \left\{ \left[\frac{\varepsilon_b + \varepsilon_c \cos\gamma + \varepsilon_c^2 (1-F_{c,s})}{\varepsilon_b + \varepsilon_c F_{c,s} + \varepsilon_c^2 (1-F_{c,s})} \right] \frac{(\alpha - f\eta)\, S_{\oplus} \cos\gamma}{(\varepsilon_b + \varepsilon_c \cos\gamma)\, \delta^2 \sigma} \right\}^{1/4} \tag{C18}$$

For values of the parameters in Equation (C18) representative of the GE array and for the range of $F_{c,s}$ reported earlier, the deviation of T_c was found to be less than 1°C traceable solely to V-stiffened geometry for γ between 3 and 8° of arc. This result is valid over all heliocentric distances greater than about 0.71 AU. At lesser distances, array rotation is required to prevent the cell temperature from exceeding the 120°C design temperature limit. In such circumstances, however, blanket flatness plays a far greater role in half blanket temperature uniformity than does the V-stiffening angle.*

c. Conclusion. Temperature non-uniformities induced in the GE solar array blankets, due solely to the V-stiffened geometry, have been determined to be negligible.

*It should be cautioned that whenever array rotation is performed, significant temperature level differences will occur between the two half blankets since their solar angles of incidence are, then, no longer equal -- not even for perfectly flat half blankets. This effect is discussed in the previous section.

APPENDIX D

DERIVATION OF THE PARAMETRIC SCALING EQUATIONS

CONTENTS

APPENDIX D

DERIVATION OF THE PARAMETRIC SCALING EQUATIONS

This appendix contains the derivations of the parametric scaling equations for this study. The appendix is divided into two sections, the weight scaling equations and the frequency scaling equations. The following subjects are treated in this appendix:

<u>Section I Weight Scaling Equations</u>

Part 1. Parametric Data for Coilable Lattice Booms for Deploying and Supporting Solar Cell Arrays from Spacecraft.

The pertinent equations for the weight and dimensions of the extensible boom and canister are developed. The derivation assumes a foldout LMSC type extensible boom design — constant strain longerons and a packaging volume constraint. These data were supplied to JPL by AEC-ABLE Engineering Co. under contract. This section contains the final report for the work.

Part 2. Boom and Canister Weight Equations for minimum system weight. The pertinent equations for the weight and dimensions of the extensible boom and canister are developed. The derivations differ from Part 1 in that a minimum system weight is sought. The system weight is defined as the sum of the boom and canister weight. The derivations are applicable to the GE rollout array concept. These data were prepared by AEC-ABLE Engineering Co. as an addendum to Part 1, above.

Part 3. Scaling Equations for the Weights of the Structural Elements.

Part 4. Scaling Equations for the Weights of the Mechanisms.

Section II. Frequency Scaling Equations

Part 1. Frequency Equations for the LMSC Foldout Concept.

Part 2. Frequency Equations for the GE Rollout Concept.

Part 3. Frequency Equations for Position Boom Scaling.

APPENDIX D

SECTION I

PART 1

PARAMETRIC DATA FOR COILABLE LATTICE BOOMS FOR DEPLOYING AND SUPPORTING SOLAR CELL ARRAYS FROM SPACECRAFT.

AECR7821/115
May 12, 1978

PARAMETRIC DATA FOR COILABLE LATTICE BOOMS FOR DEPLOYING AND SUPPORTING SOLAR CELL ARRAYS FROM SPACECRAFT

for

JET PROPULSION LABORATORY

Purchase Order No., JS-685133

Prepared by

AEC-ABLE ENGINEERING CO., INC.
P. O. Box C
Goleta, California 93017

R. F. Crawford

INTRODUCTION AND SUMMARY

The objective of this investigation was to provide parametric design data on coilable lattice booms for deploying and supporting solar cell arrays from spacecraft. Figure 1 shows a coilable lattice boom along with its nomenclature. Figure 2 is a sketch of a canister of the type which would be necessary for stowing and deploying the coilable boom for a solar array application.

The boom and canister indicated here are the same types as selected by Lockheed, MSC (LMSC) and General Electric (GE) in their recent investigations (see References 1 and 2, respectively) of deployable solar cell arrays for spacecraft. ABLE designed, fabricated and delivered a full-scale engineering model of their solar array extension boom and canister, as part of the LMSC investigation. The results of that experience are reflected in the present data, but GE's analytical results were also reviewed at the outset of this investigation.

Parametric equations and graphs are presented here, which define relationships among weight, stiffness, size and other parameters of this type of boom and canister. The relationships and graphs presented in the text of this report apply to scaling of the aforementioned particular boom and canister designs

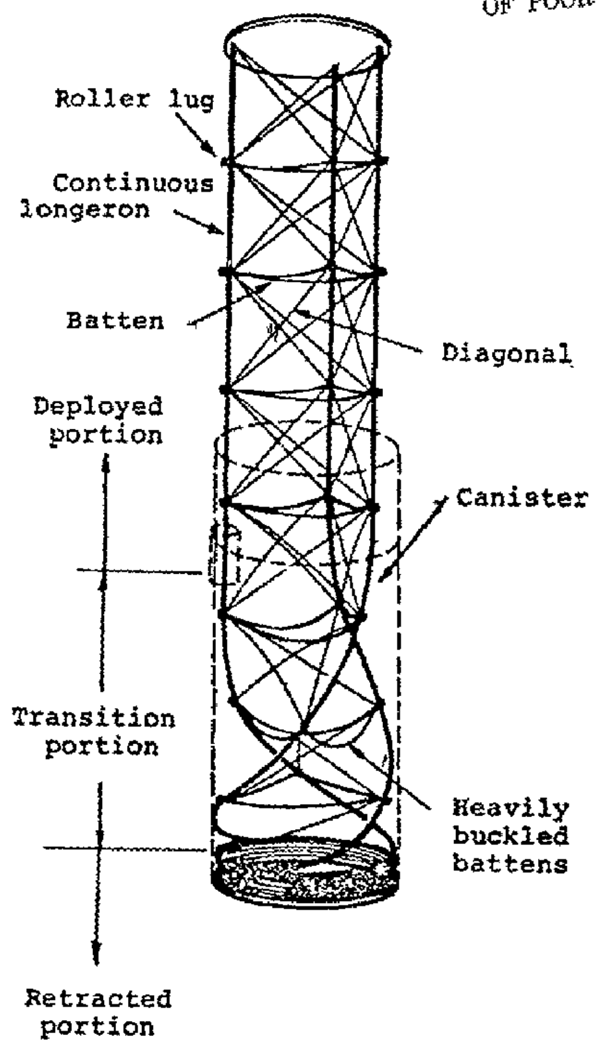


Figure 1. Deployment Geometry and Nomenclature for Continuous-Longeron Lattice Booms

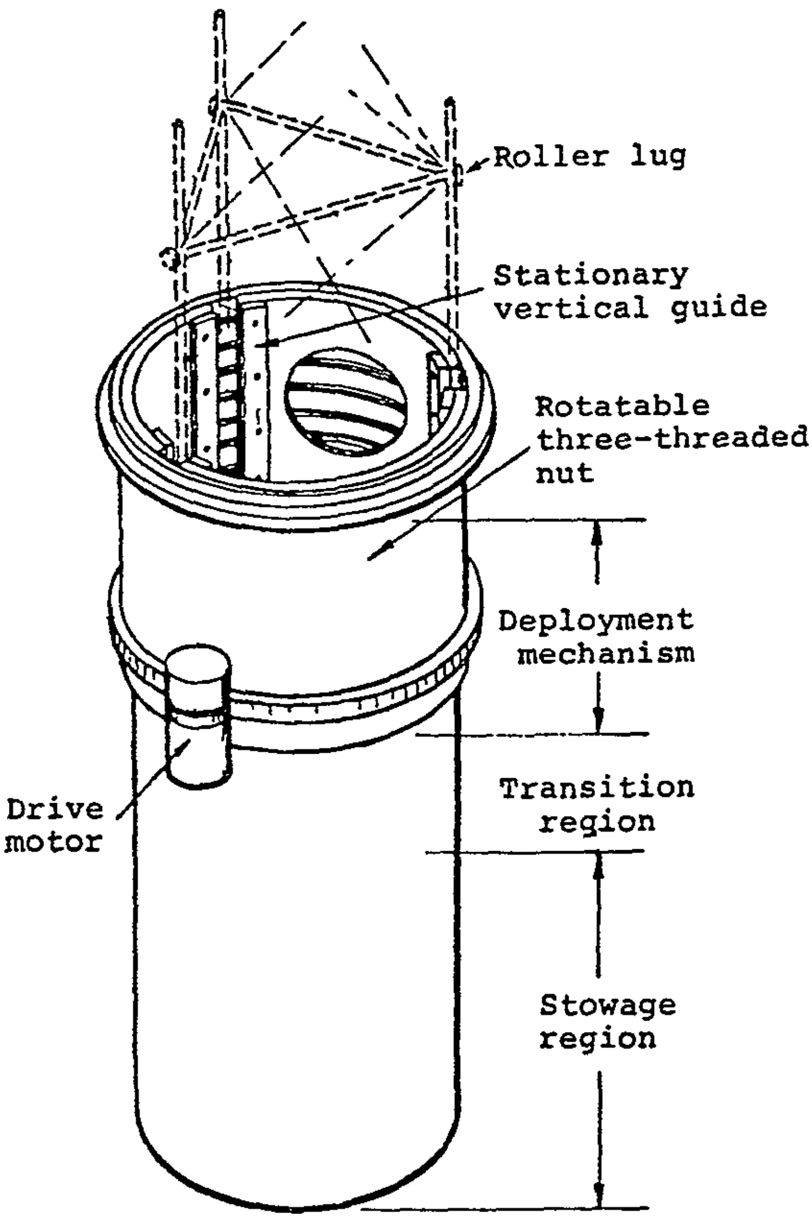


Figure 2. Canister for Deploying and Supporting Continuous-Longeron Lattice Booms

provided to LMSC. However, the derivations of the relationships, which are presented in the Appendix of this report, have greater generality so that they can be more broadly applied.

ASSUMPTIONS FOR PARAMETRIC DATA

Following are the assumptions made in deriving the parametric data presented in this report for coilable lattice booms and their deployment canisters.

General Assumptions

1) All the parametric data presented here are semi-empirical, based on engineering formulations which are correlated to actual measurements of properties of the aforementioned LMSC engineering model of a solar array extension boom and its canister.

2) The appendix of this report gives derivations of the equations and graphs presented in the text. Those derivations include general formulations which may be applied to booms and canisters of materials and geometries dissimilar to those presently used for empirical correlation.

3) The parametric data apply to both the LMSC and GE concepts (see JLP SOW) except as noted for the strengths of the eccentrically loaded LMSC concept and the axially loaded GE concept.

4) The data apply to booms and canisters operating over the 0.3 to 6.0 AU range, provided the boom and canister

temperature remain less than 150°C. This upper temperature limit for deploying or retracting the S-glass/epoxy boom is based on the suppliers' data and indicate the epoxy becomes thermal-plastic at that temperature. There appears to be no lower temperature limit on operation of the boom.

Boom Assumptions

1) Longeron and batten members of the boom are solid, circular, initially-straight rods of S-glass/epoxy material having the following properties:

Density, $\rho = 0.070$ pci

Young's modulus, $E = 7.1 \times 10^6$ psi (axial)

Ultimate bending strain, $\varepsilon_{ult} > 0.030$

(E and ε_{ult} unaffected by temperature variations from -180 to + 150°C.)

2) The longeron bending strain when fully coiled is $\varepsilon = 0.015$

3) The nominal boom radius R refers to a circle through the centerlines of the three longerons. Overall boom radius $R_o = 1.08R$

4) Batten diameter is 0.80 times longeron diameter.

5) Batten spacing ℓ is $\ell = 1.25R$

6) Entire boom length required for an application is the sum of the length to be extended plus an additional length of 1.1 times the canister length, which latter length remains

in the canister.

7) Boom weight scales continuously as a constant times weight of longerons in the boom.

8) Diagonal members of boom are steel cables whose extensional stiffness is assumed to be a constant proportion of the longeron extensional stiffness. This assumption is compatible with assumption number 7, above. It also implies that the torsional and bending stiffnesses of the boom are in constant proportion to one another; independent of R, as defined later.

Canister Assumptions

1) The canister configuration is generally that indicated by Figure 2. Most of its construction is of aluminum, except for the fiberglass/epoxy shell in the three-threaded nut assembly.

2) Over the scaling range canister weights per unit exterior area remain constant at one value for areas associated with the stowage region and at another for the remaining regions.

3) The non-stowage region of the canister consists of its base, transition region, deployment mechanism and two motors. Assumption number 2, above, along with the additional assumption that motor weight is proportional to power required, implies motor weight is proportional to R^2. This conclusion implies power required is proportional to boom bending strength times the nut angular velocity for deployment speeds which are

independent of R .

4) Canister scaling equations apply only when used with booms subject to the aforelisted boom assumptions.

5) Only the weight and length of this stowage region of the canister are affected by boom length L ; properties of its other regions are independent of L .

6) Aside from the motors or other small protrustions, the clearance diameter of the canister is approximately 18% larger than the nominal boom diameter.

Interface Bending Stiffness Assumptions

1) The foregoing assumptions regarding the boom also apply to the interface stiffness.

2) Longeron loads are reacted eccentrically on the roller lugs at a distance which is directly proportional to boom radius.

3) No deformations take place in the canister in reaction to boom loads.

PARAMETRIC DATA

Parametric data presented here apply over the following range, as specified in the JPL Statement of Work:

Boom lengths, $L = 45$ to 295 feet

Bending stiffness, $EI = 4.8 \times 10^3$ to 2.8×10^9 lb-in^2

Axial compressive loading, $P = 2$ to 450 pounds

For applications to the LMSC solar array concept, P acts eccentrically at the following distance e in the direction normal to a flat side of the boom:

$$e = R + 3.325 \text{ inches}$$

For applications to the GE concept, P acts along the boom axis.

All the following formulations are derived in the Appendix of this report.

Boom Weight, W_B

The boom weight per unit length W_B/L is formulated in terms of its bending stiffness EI as

$$\frac{W_B}{L} = 8.28 \times 10^{-5}\sqrt{EI} \text{ (lb/ft)}$$

or in terms of boom radius R as

$$\frac{W_B}{L} = 7.19 \times 10^{-3} R^2 \text{ (lb/ft)}$$

In these formulations, W_B/L has units of pounds per foot when the units of EI are lb-in^2 and R is in inches.

Note also that EI is related to R by

$$EI = 7530\ R^4\ (in^2\text{-}lb)$$

for the above two equations to be compatible, where R is expressed in inches.

Figures 3a and 3b are graphs of W_B/L versus EI over the range specified for EI with various boom radii in the EI range as indicated by tic marks.

W_B/L is also related to the critical axial load P_{CR} on the entire boom, which would cause local Euler buckling of its longerons in the "baylengths" between battens;

$$\frac{W_B}{L} = 1.344 \times 10^{-3}\ P_{CR}\ (lb/ft)$$

W_B/L has units of pounds per foot when P_{CR} is expressed in pounds.

Figure 4 is a graph of W_B/L versus P_{CR} with boom radii indicated by tic marks. Note that P_{CR} is related to R by the equation

$$P_{CR} = 5.348\ R^2\ (lb)$$

where the value R is expressed in inches.

Figure 4 and/or the above equations can be used to design booms for GE concepts, where the applied loads are axial.

The boom weight per unit length is also related to the minimum bending strength, M_{CR} ; the bending strength when one longeron is compressed so as to cause it to locally buckle, and the other two longerons are equally tensioned. That relationship

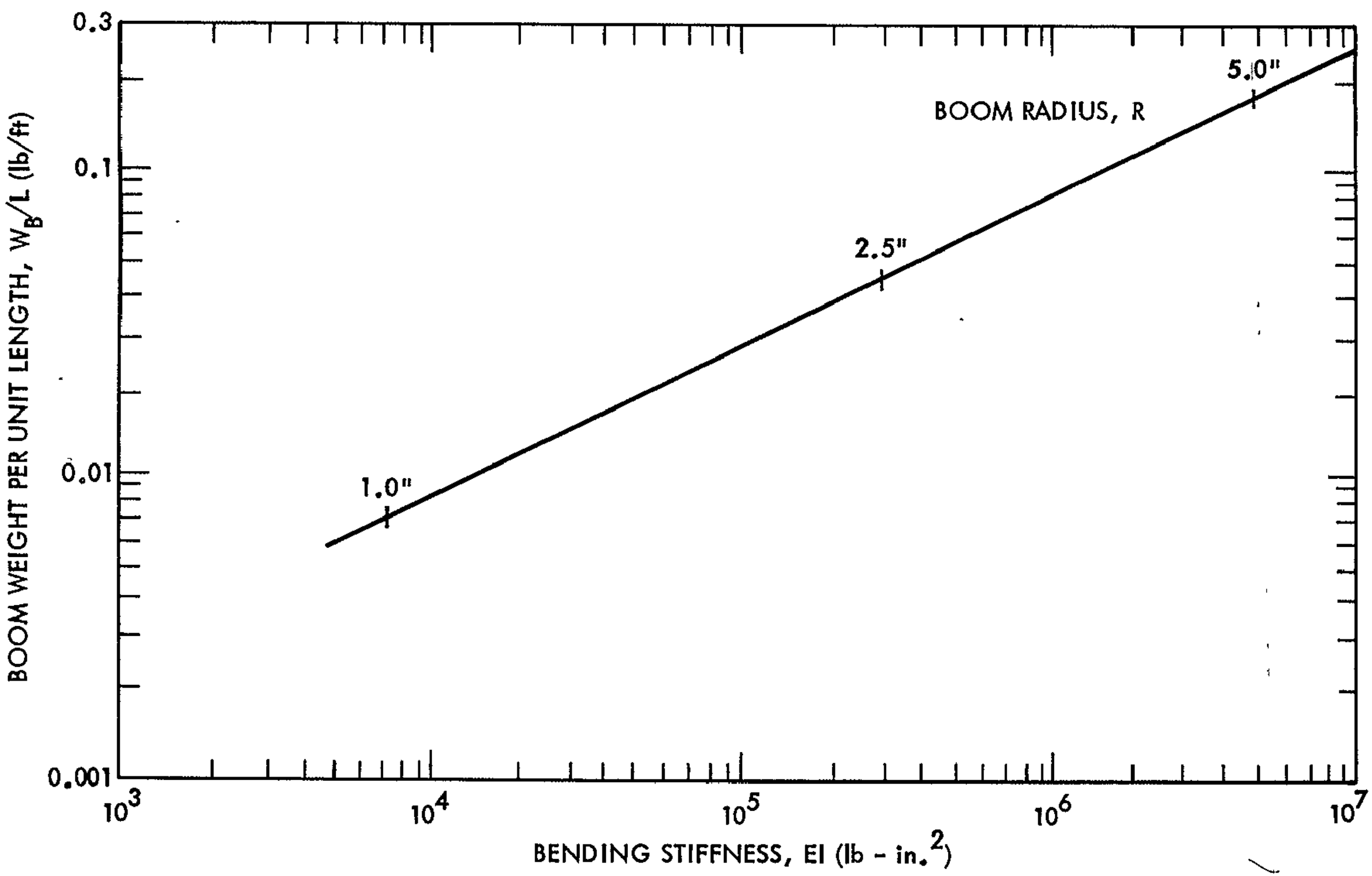


Figure 3a. Boom Weight Versus Bending Stiffness and Radius; Lower Part of Stiffness Range

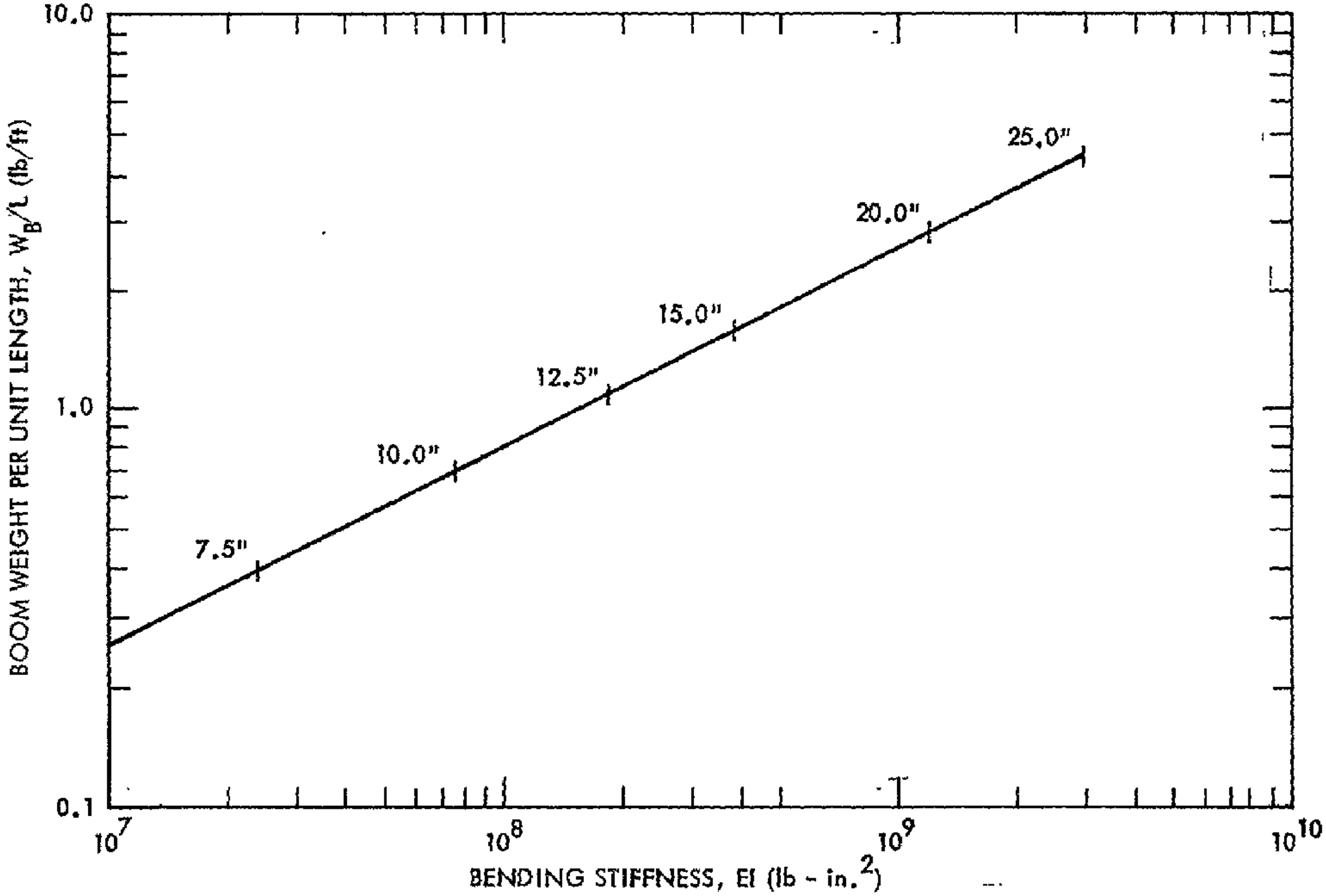


Figure 3b. Boom Weight Versus Bending Stiffness and Radius; Part of Stiffness Range

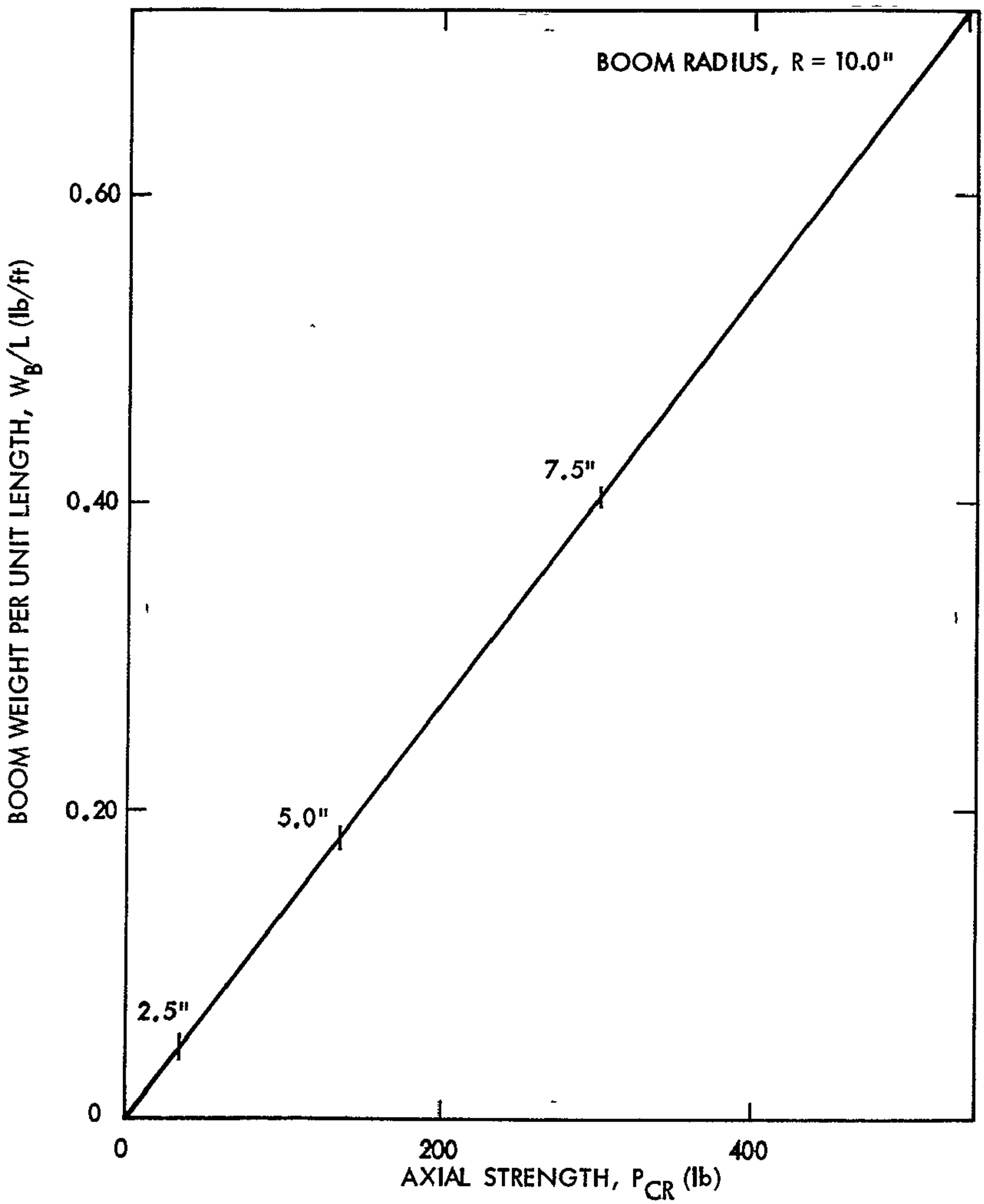


Figure 4. Boom Weight Versus Axial Strength as Limited by Local Longeron Buckling

is

$$\frac{W_B}{L} = 3.73 \times 10^{-3} M_{CR}^{2/3} \quad \text{(lb/ft)}$$

W_B/L has the indicated units of pounds per foot when M_{CR} is expressed in inch-pounds. Figure 5 is a graph of W_B/L versus M_{CR} with various values of R indicated by tic marks. Note also that M_{CR} is related to R by

$$M_{CR} = 2.675 R^3 \quad \text{(in-lb)}$$

when R is expressed in inches.

Booms For LMSC Concept:

An analysis of the LMSC boom concept is given in the Appendix. It determines the radius of a coilable lattice boom, of overall length L, so that it can withstand an ultimate load P_{ult} which acts eccentrically at a distance

$$e = R + 3.325 \quad \text{(in)}$$

The direction of eccentric loading is such that the resulting bending moment tensions one longeron and equally compresses the other two.

The derived relationship among variables L, R and P_{ult} is

$$\frac{5.349 R^2}{P_{ult}} = 1 + \frac{1 + \frac{3.325}{R}}{1 - \frac{P_{ult} L^2}{8(7530) R^4}}$$

Solutions to this equation are given graphically in Figure 6.

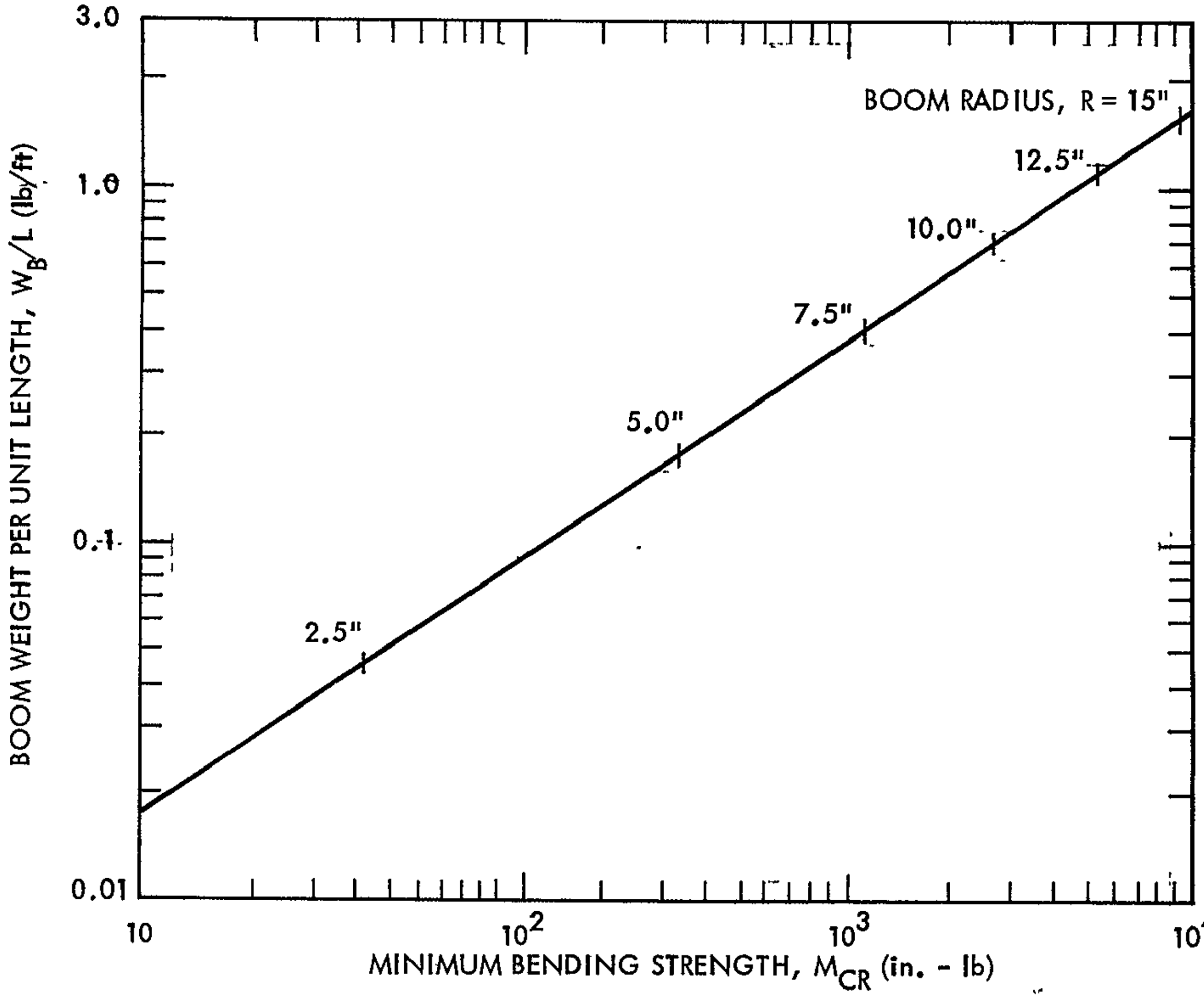


Figure 5. Boom Weight Versus Minimum Bending Strength As Limited By Local Longeron Buckling

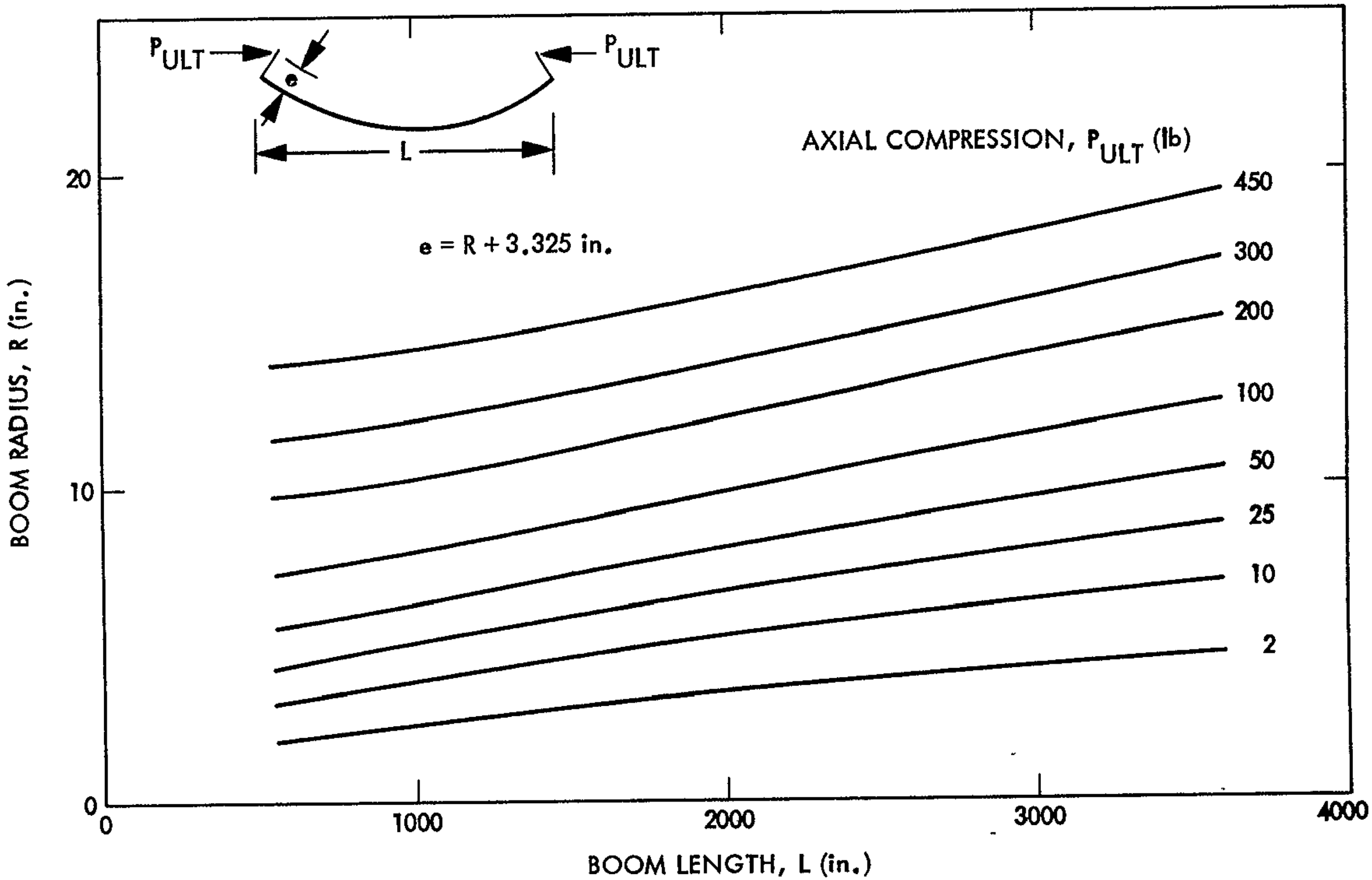


Figure 6. Required Radii For Booms of Length L to Withstand Eccentric Axial Load P_{ult}

Canister Size and Weight

The required length H_{can} for a canister which can stow and deploy a boom of length L and radius R is

$$H_{can} = 0.022\ L + 3.3\ R \text{ (inches)}$$

where L and R are both expressed in inches. The first term accounts only for the stowage part of the canister; while the second term accounts for all other parts including the base, transition region and rotating deployment mechanism (see Figure 2). Figure 7 is a graph of H_{can} versus L and R. Note that H_{can} can also be explicitly related to EI rather than R by using the previously given relationship between EI and R.

The canister diameter D_{can} is approximated by

$$D_{can} = 2.36\ R$$

D_{can} does not include protrusions due to motors or other items.

Weight W_{can} for a canister which can stow and deploy a boom of length L and radius R is

$$W_{can} = 5.21 \times 10^{-4}\ LR + 0.553\ R^2 \text{ (lb)}$$

where L and R are expressed in inches. The first term accounts for the weight of the stowage region and the second term accounts for all other parts.

Figure 8 is a graph of W_{can} versus L and R. As noted for H_{can}, the canister weight can also be expressed explicitly in terms of EI.

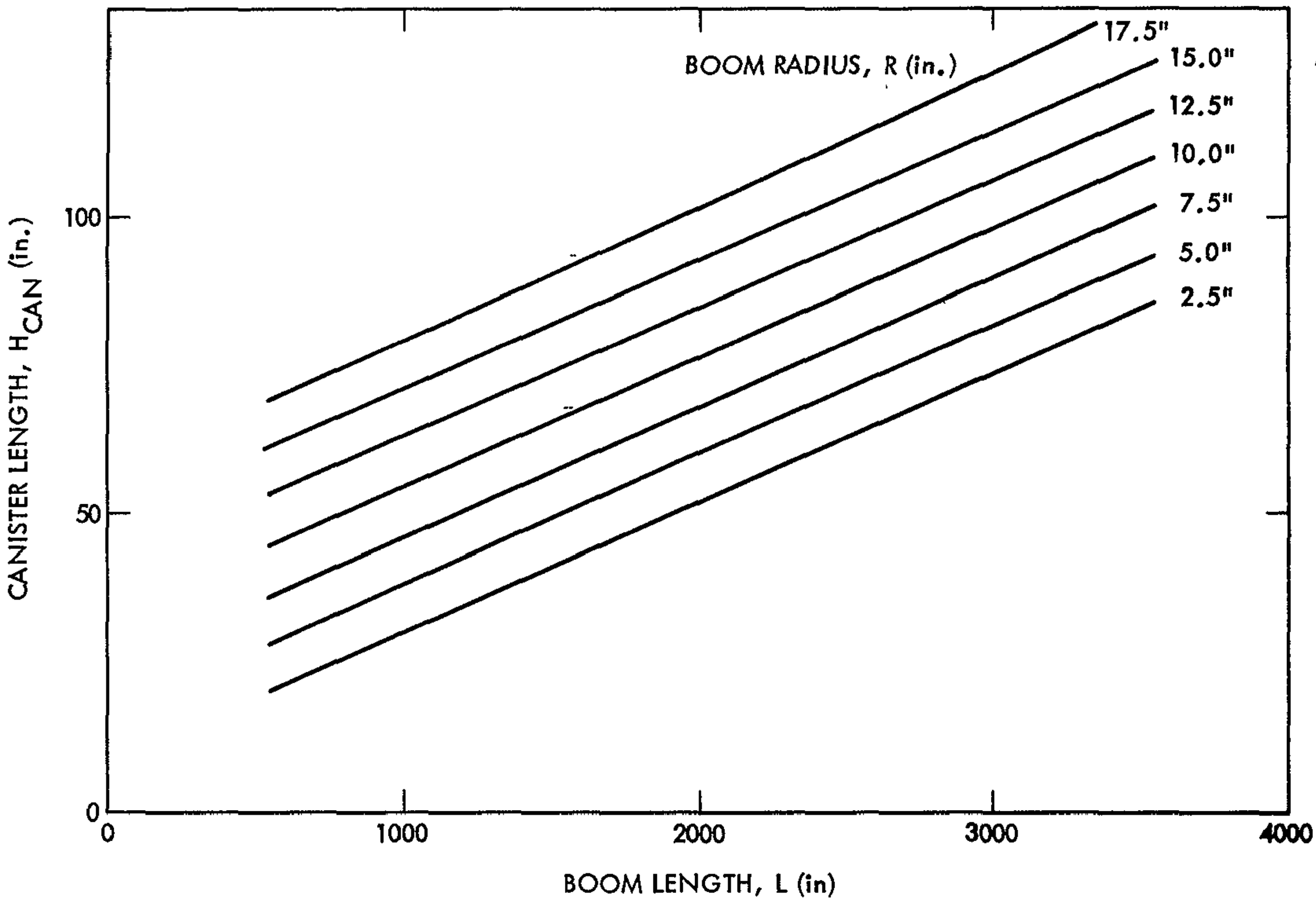


Figure 7. Required Canister Lengths For Booms of Specified Lengths and Radii

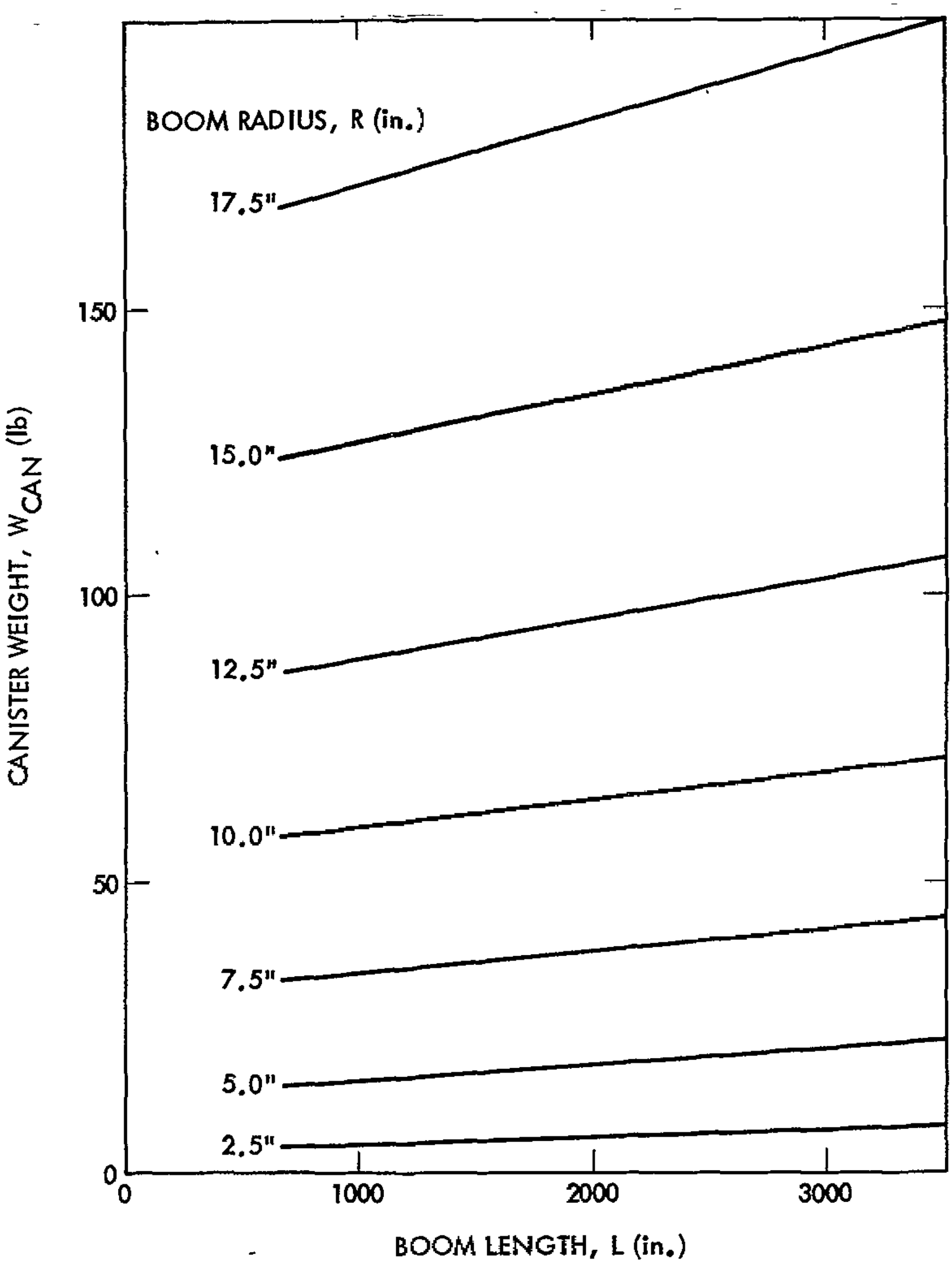


Figure 8. Canister Weights For Booms of Specified Lengths and Radii

Interface Bending Stiffness

The bending stiffness K of the interface between the boom and canister is defined by

$$K = \frac{M}{\theta}$$

where M = bending moment to which the interface is subjected by the boom.

and θ = angular displacement of boom axis, relative to canister axis, in response to M.

Note that θ does not include effects of overall bending of the boom; only effects of longeron loads being reacted eccentrically by the canister which causes local longeron bending. K is related to boom bending stiffness EI by

$$K = 0.729\ EI^{3/4} \left(\frac{\text{in-lb}}{\text{radian}}\right)$$

when the units of EI are lb-in^2. Figures 9a and 9b are graphs of K versus EI with tic marks indicating various values of R over the range of EI.

Boom Torsional Stiffness, $\overline{GJ}$

The torsional stiffness of a coilable lattice boom is given by the formula

$$\overline{GJ} = 1.154\ R^2\ \overline{EA}_{Diag}$$

where $\overline{EA}_{Diag}$ = extensional stiffness of a diagonal cable and the batten spacing is 1.25 R. Although there is no particular necessity for it, the foregoing boom weight formulation implies that the ratio of diagonal-to-longeron cross-sectional

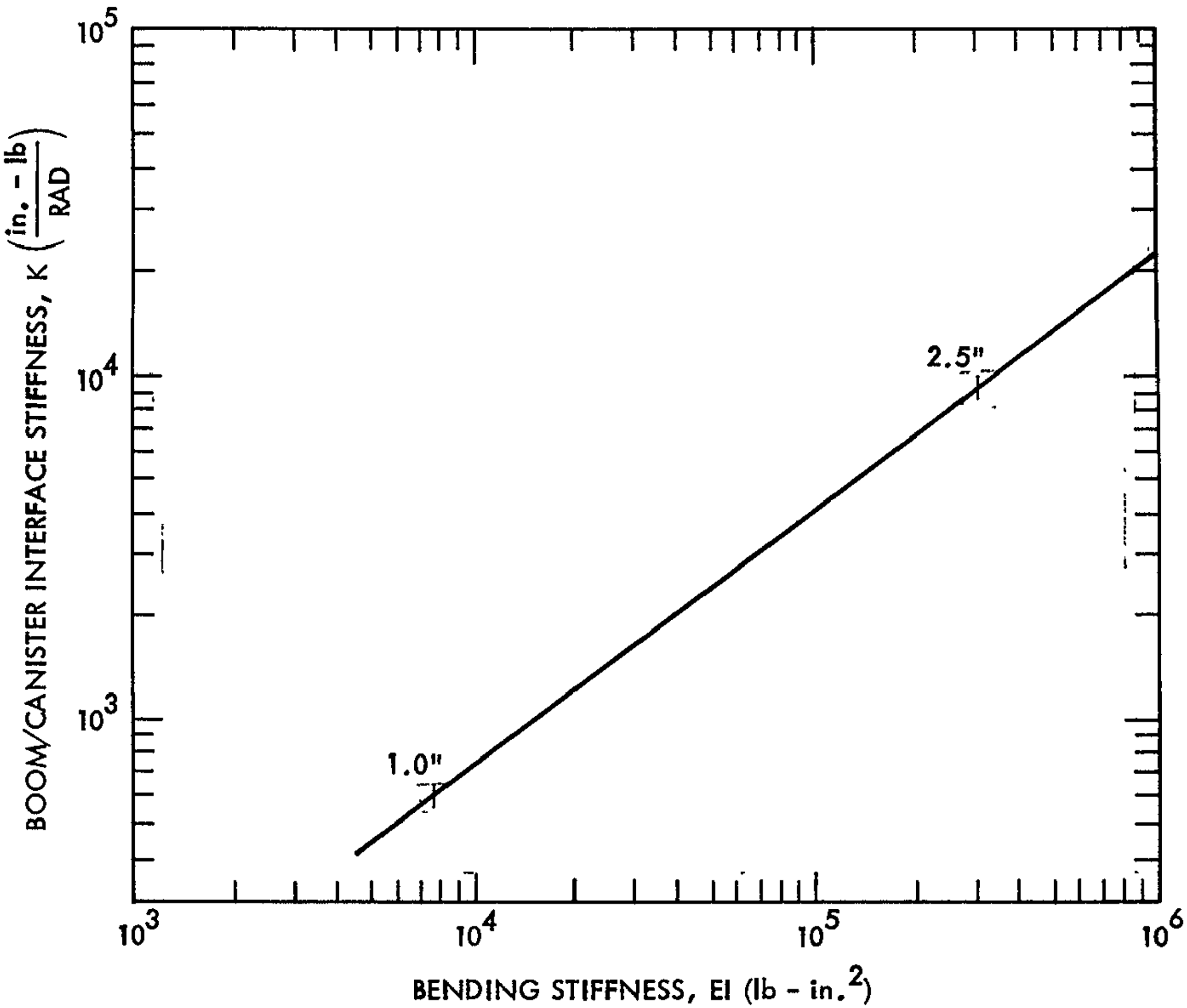


Figure 9a. Boom/Canister Interface Bending Stiffness For Booms of Specified Bending Stiffnesses; Lower Part of Stiffness Range

D27

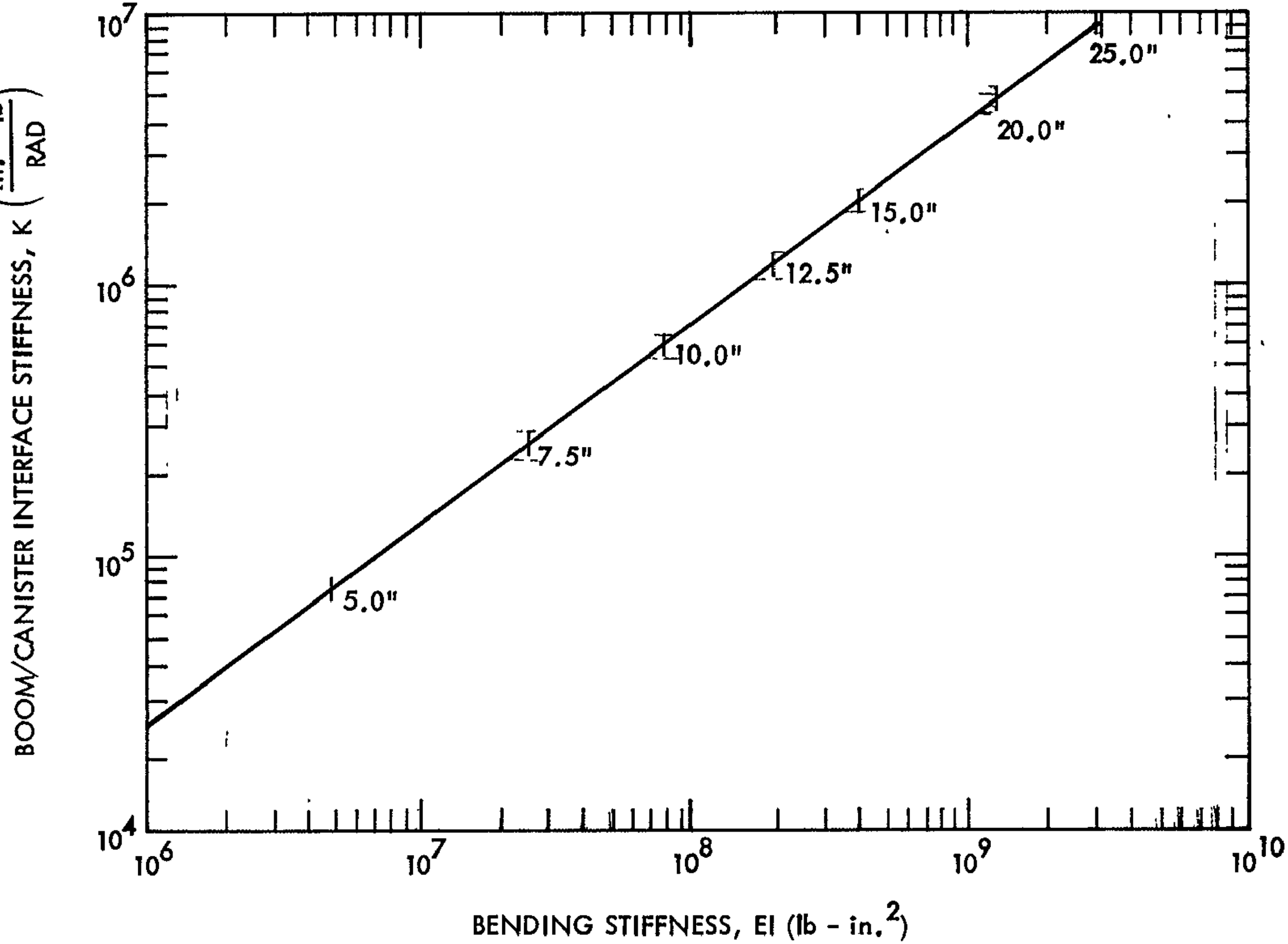


Figure 9b. Boom/Canister Interface Bending Stiffness for Booms of Specified Bending Stiffnesses; Upper Part of Stiffness Range

areas is independent of scale. Accordingly, the ratio of $\overline{GJ}$ -to- EI is independent of boom size. The following correlation which exists for the LMSC SEP boom is, therefore, assumed to exist for booms of other sizes.

$$\overline{GJ} = 0.020\ EI$$

<u>Boom Shearing Stiffness, $\overline{GA}$</u>

Because $\overline{GA}$ is related to $\overline{GJ}$ by the equation

$$\overline{GA} = \frac{2\overline{GJ}}{R^2}$$

and because

$$EI = 7530\ R^4$$

then,

$$\overline{GA} = 301\ R^2$$

TYPICAL DESIGNS

Following are typical boom and canister design properties for LMSC and GE concepts.

LMSC Concept

A Solar Electric Propulsion (SEP) stage requirement for two 12.5 kw deployable solar array wings led to LMSC's specification that its deployable lattice booms be 105 feet long and have $EI \approx 19.5 \times 10^6$ lb-in^2. These specifications resulted in the following boom and canister design properties for the LMSC concept.

LMSC Boom

Overall length; $L = 111$ ft

Boom radius; $R = 7.2$ in.

Boom weight; $W_B = 41.0$ lb

Longerons; S-glass/epoxy rods, 0.215 inch diameter,

$E = 7.1 \times 10^6$ psi, $\varepsilon_{ult} > 3.5\%$

Battens; S-glass/epoxy rods, 0.170 inch diameter

Diagonals; 3/64 inch diameter, 3 x 7 strand stainless steel cable

$EI = 21 \times 10^6$ lb-in^2

$\overline{GJ} = 4.0 \times 10^5$ lb-in^2

P_{CR} = 275 lb

M_{CR} = 1,000 in-lb

$K = 2.2 \times 10^5 \frac{\text{in-lb}}{\text{rad}}$

Preliminary designs for this application called for S-glass/polyimide, rather than S-glass/epoxy, to enable the boom to be coiled at temperatures up to about 550° F. However, over the temperature range specified by JPL, the two materials would have almost identical properties.

LMSC Canister

H_{can} = 60 inches

W_{can} = 33.7 lb

D_{can} = 16.8 inches

Material: 6061-T6 aluminum skin and machined parts; 16 inch diameter steel Kaydon bearings; S-glass cloth/epoxy shell for deployment nut.

Motors: 2-28 volt DC with 30.7:1 gearheads; 4.9 in-lb maximum rated output torque.

GE Concept

A SEP stage requirement led to a GE boom design for which L = 198.5 feet and R = 10 inches. For those dimensions, the boom and canister would have the following properties, based on the foregoing parametric data:

GE Boom

Overall length; L = 206.3 feet

Boom radius; $R = 10$ inches

Boom weight; $W_B = 148$ lb

Longerons; S-glass/epoxy rods, 0.30 inch diameter,

$$E = 7.10 \times 10^6 \text{ psi}, \ \varepsilon_{ult} > 3.5\%$$

Battens; S-glass/epoxy rods, 0.24 inch diameter

Diagonals; 1/8 inch diameter steel cable

$EI = 7.53 \times 10^7 \text{lb-in}^2$

$\overline{GJ} = 1.5 \times 10^6 \text{ lb-in}^2$

$P_{CR} = 535$ pounds

$M_{CR} = 2,675$ in-lb

$K = 5.9 \times 10^5 \ \frac{\text{in-lb}}{\text{rad}}$

<u>GE Canister</u>

$H_{can} = 85.4$ inches

$W_{can} = 68.2$ pounds

$D_{can} = 23.6$ inches

REFERENCES

1. Lockheed Missiles and Space Company Report No. LMSC-D492693 "Solar Array Technology Development for SEP", January 18, 1977.

2. General Electric Space Division Report No. 77SDS4207 "Final Report Phase I Conceptual Approach Study 200 w/kg Solar Array", August 31, 1977

AEC-ABLE ENGINEERING CO., INC.
Goleta, California 93017

AECR7821/115
May 12, 1978

Appendix

DERIVATION OF PARAMETRIC DATA FOR COILABLE LATTICE BOOMS

Appendix

DERIVATION OF PARAMETRIC DATA

FOR

COILABLE LATTICE BOOMS

Boom Weight

It is assumed that boom weight W_B scales proportionally to its longeron weight. Accordingly, for solid longerons of cross-sectional area A_ℓ and a material whose density is ρ ,

$$W_B = CA_\ell \rho L$$

where C = constant to be empirically determined

and L = boom length

The cross-sectional dimension of the longerons in the radial direction from the mast axis is limited by the allowable coiling strain ε of the longeron material. For instance, for either square or round longerons, their maximum coiling strain ε will be

$$\varepsilon = \frac{d}{2R}$$

where d = longeron radial dimension

and R = boom radius

Then

$$W_B = C\rho\varepsilon^2 R^2 L$$

C = 37.7 for LMSC SEP type boom

The allowable coiling strain for a given material must be determined experimentally.

For the LMSC engineering model of the SEP solar array extension boom,

$$W_B = 41.0 \text{ pounds}$$

and for its S-glass/epoxy longeron material, the allowable working strain ε was selected on the basis of prior experimentation, to be

$$\varepsilon = 0.015$$

The density of the longeron material was determined to be

$$\rho = 0.070 \text{ pci}$$

Accordingly, for coilable lattice booms similar to the LMSC SEP design

$$W_B = 5.99 \times 10^{-4} R^2 L \text{ (pounds)}$$

where W_B has units of pounds only when R and L have units of inches.

Bending Stiffness

The three longeron axes for this type of boom form equilateral triangles. The radius of gyration R_G for the area of the longerons is then

$$R_G{}^2 = \frac{R^2}{2}$$

Accordingly, the cross-sectional moment of inertia for the boom is

$$I = 1.5\, A_\ell R^2$$

Its bending stiffness is then

$$EI = 1.5\ EA_{\ell}R^2$$

where E = Young's modulus for the longeron material.

Consistent with the foregoing discussion, EI can be expressed in terms of the longeron coiling strain of a boom with circular solid longerons as

$$EI = 1.5\ \pi E R^4 \varepsilon^2$$

For the SEP S-glass/epoxy longerons,

$$\varepsilon = 0.015$$

and $E = 7.1 \times 10^6$ psi

Accordingly,

$$EI = 7530\ R^4 \quad (\text{lb-in}^2 \text{ when } R = \text{inches})$$

for booms similar to the LMSC SEP model.

Axial Strength

One limit on the axial compressive strength of the coilable lattice boom is imposed by longeron Euler buckling, with simply-supported nodes at the batten spacing ℓ . This buckling strength for a circular solid longeron of diameter d is

$$P_{\ell/CR} = \frac{\pi^3 E d^4}{64\ell^2}$$

Since $\ell = 1.25\ R$

for good stowage compactness, and since

$$\varepsilon = \frac{d}{2R}$$

then $P_{\ell/CR} = 4.961\ E\varepsilon^4 R^2$

Therefore, for booms similar to the LMSC SEP model

$$P_{CR} = 5.348R^2 \text{ (lb when R = inches)}$$

Bending Strength

The bending strength of this boom is also limited by longeron Euler buckling, and the minimum strength is when the bending moment acts in a direction to compress one longeron while equally tensioning the other two. For that condition, the bending strength M_{CR} is given by

$$M_{CR} = 1.5\ RP_{\ell/CR}$$

By using the previously given formula for $P_{\ell/CR}$, M_{CR} becomes

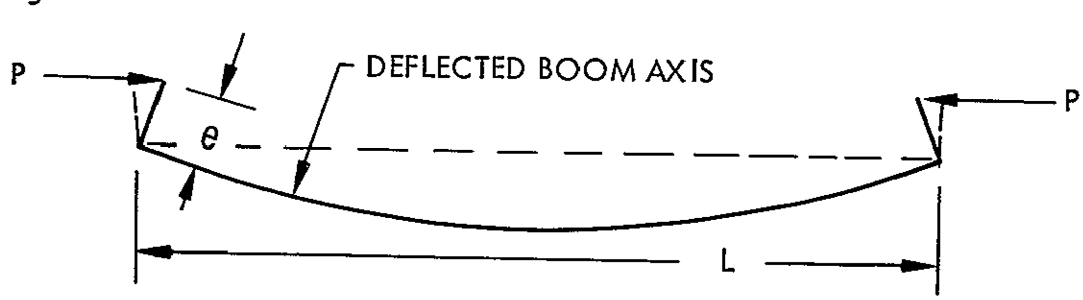
$$M_{CR} = 7.442\ E\varepsilon^4 R^3$$

And for booms similar to the LMSC SEP model,

$$M_{CR} = 2.675\ R^3 \text{ (in-lb when R = inches)}$$

Strength Under Eccentric Loading

The strength of a coilable lattice boom is derived here for the eccentric compressive loading indicated by the following schematic.



The boom is so-oriented that one longeron is tensioned and two are equally compressed by the applied loading. This represents the LMSC design concept for which

$$e = R + 3.325 \text{ inches}$$

From Roark, "Formulas for Stress and Strain", page 136, the maximum bending moment M under this loading condition occurs at the boom midlength,

$$M = \frac{Pe}{\cos\frac{\pi}{2}\sqrt{\bar{p}}}$$

where $$\bar{p} = \frac{P}{P_{Eu}}$$

and $$P_{Eu} = \frac{\pi^2 EI}{L^2} = \text{Euler buckling strength for overall boom}$$

The maximum compressive load in a longeron is found from statics,

$$P_\ell = \frac{P}{3} + \frac{M}{3R}$$

$$= \frac{P}{3}\left(1 + \frac{e}{R\cos\frac{\pi}{2}\sqrt{\bar{p}}}\right)$$

Failure occurs when

$$P_\ell = P_{\ell/CR}$$

By using the previously given equations for $P_{\ell/CR}$, e , and E , and by using the first two terms in the series expansion of $\cos\frac{\pi}{2}\sqrt{\bar{p}}$, the preceding equation for P_ℓ becomes

$$1.783\ R^2 = \frac{P}{3}\left[1 + \frac{1 + \dfrac{3.325}{R}}{1 - \dfrac{PL^2}{8(7530\ R^4)}}\right]$$

Again, this equation applies only to booms similar to the LMSC SEP model.

Canister Height

The height of a canister H_{can} for coilable lattice booms is the sum of three principal parts (see Figure 2 of text)

$$H_{can} = H_{stow} + H_{trans} + H_{mech}$$

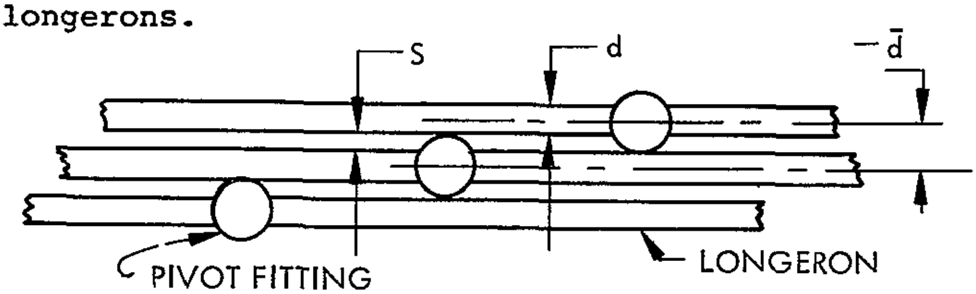
where

H_{stow} = length required for stowing the retracted boom

H_{trans} = transitional length of boom, between fully coiled and fully deployed configurations

and H_{mech} = length required for the three-threaded nut deployment mechanism

H_{stow} is derived by considering the following sketch of the coiled longerons.



$$H_{stow} = \frac{3L\bar{d}}{2\pi R}$$

where

$\bar{d} = d + S =$ effective longeron diameter

$d =$ actual longeron diameter

$S =$ Spacing between longerons as caused by pivot fitting

Since $\varepsilon = \dfrac{d}{2R}$

then $H_{stow} = \dfrac{3L}{\pi}\left(\varepsilon + \dfrac{S}{2R}\right)$

For the LMSC SEP boom

$$\varepsilon = 0.015$$

and $\dfrac{S}{2R} = 0.008$

Therefore,

$$H_{stow} = 0.022\ L$$

for booms of that type.

Measurements of coilable lattice booms typified by the LMSC SEP model have indicated their transition length is directly proportional to their radii;

$$H_{trans} \simeq 1.8\ R$$

for ε [illegible]

The three-threaded nut of the deployment mechanism must secure one set of roller lugs at all times, which requires that the nut must be longer than ℓ . Note that

$$\ell = 1.25\ R$$

for the LMSC SEP model. To allow for suitable margin on this

length of the nut and for the bearings and canister base, H_{mech} is taken as

$$H_{mech} = 1.50 R$$

Accordingly, the total canister height is

$$H_{can} = 0.022 L + 3.30 R \text{ (inches)}$$

where H_{can} has inch units when L and R are expressed in inches.

Canister Weight

The total weight of the canister for the LMSC SEP boom is taken to be

$$W_{can} = 33.7 \text{ pounds}$$

(after adjustment for some weight that is removable from the delivered hardware). This weight is considered to be the sum of several parts.

$$W_{can} = W_{stow} + W_{trans} + W_{mech}$$

where W_{stow} = weight of cylinder in which boom stows

W_{trans} = weight of cylinder and tracks in the transition region

and W_{mech} = weight of deployment mechanism, including nut, guides, bearings, motors and base.

All these weights are assumed to be constant per unit of exterior surface area. The surface area of the stowage region, therefore, is proportional to LR and the weight for the

transition and mechanism regions is proportional to R^2.

Accordingly,

$$W_{can} = C_1 LR + C_2 R^2$$

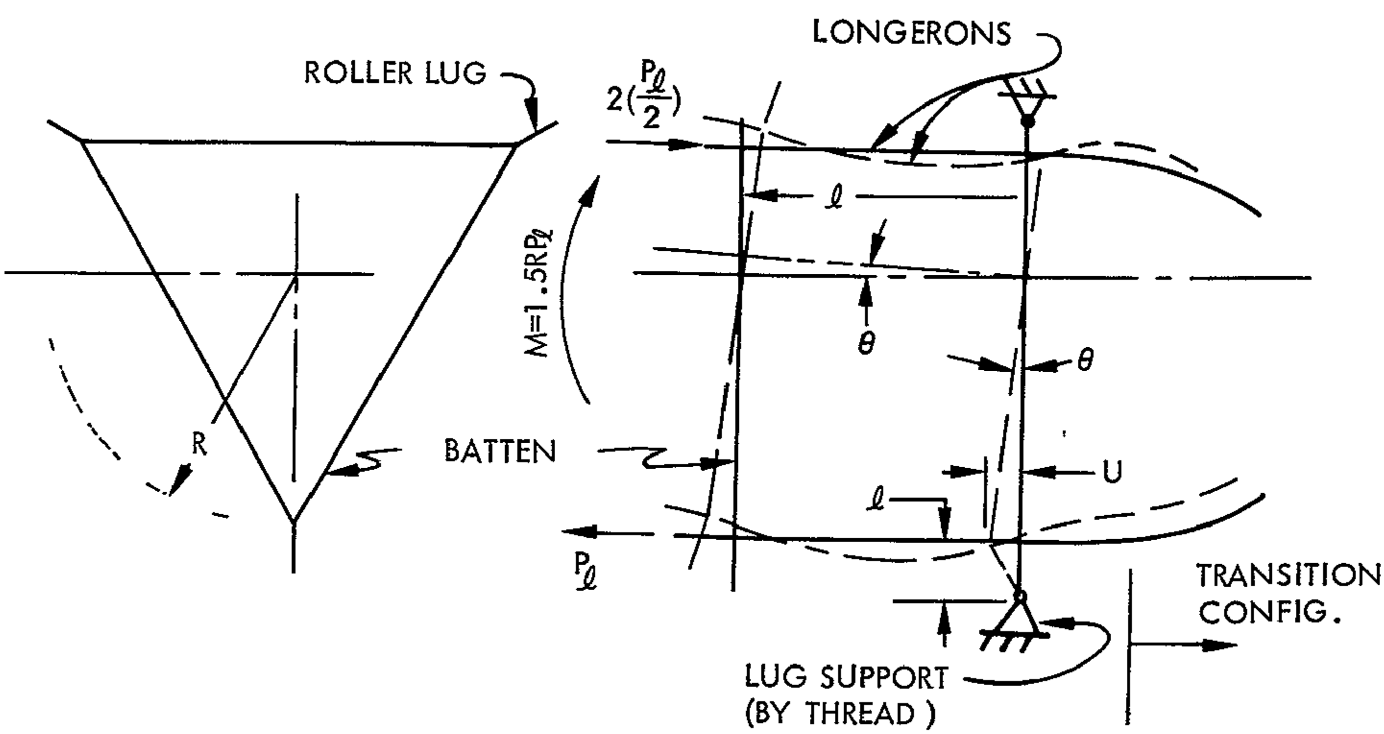
Since the stowage barrel weighed approximately 5.0 pounds for the SEP boom, the above equation becomes

$$W_{can} = 5.21 \times 10^{-4} LR + 0.553 R^2 \text{ (pounds)}$$

where W_{can} is in pound units only when L and R are expressed in inches.

Interface Bending Stiffness

This stiffness is derived by considering the schematic drawing below for bending a boom when its longeron loads are reacted eccentrically (and rigidly) by the threads of the deployment nut.



The axial displacement U of a longeron whose axial load is P_ℓ is given by

$$U = \frac{C_1 P_\ell e^2 \ell}{EI_\ell}$$

where

C_1 = constant, to be determined empirically

e = eccentric distance

ℓ = batten spacing

EI_ℓ = longeron bending stiffness

$= \frac{\pi E d^4}{64}$ for a solid circular rod

The rotation is $\theta = \frac{U}{R}$

Since the interface stiffness is defined by

$$K = \frac{M}{\Theta}$$

where $M = 1.5\ RP_\ell$

$$\varepsilon = \frac{d}{2R}$$

and $\ell = 1.25\ R$

then

$$K = C_2 \left(\frac{R}{e}\right)^2 E\varepsilon^4 R^3$$

where C_2 = a constant to be empirically evaluated

It is assumed that the ratio R/e is independent of R for coilable lattice booms of the type considered here. For the LMSC SEP boom

$$K = 2.2 \times 10^5 \ \frac{\text{in-lb}}{\text{radian}}$$

was measured. Also

$$E = 7.1 \times 10^6 \text{ psi}$$

$$\varepsilon = 0.015$$

and $$R = 7.2 \text{ inches}$$

Therefore,

$$K = 1640 E \varepsilon^4 R^3$$

Or, for the above values of E and ε

$$K = 589 R^3 \left(\frac{\text{in-lb}}{\text{radian}}\right)$$

where R is expressed in inches.

APPENDIX D

SECTION I

PART 2

BOOM AND CANISTER WEIGHT EQUATIONS FOR MINIMUM SYSTEM WEIGHT

APPENDIX D

SECTION I PART 2

ADDENDUM TO AECR 7821/115

BOOM AND CANISTER WEIGHT EQUATIONS FOR MINIMUM SYSTEM WEIGHT

R. F. Crawford
AEC - Able Engineering Co., Inc.

Since the GE rollout design concept utilizes near minimum system weight for the selection of the boom, the equations derived in AEC - Able Engineering Report AECR 7821/115 will be modified. The system weight is defined here as the sum of the boom weight and the canister weight.

Boom Weight

The boom weight has previously been expressed as

$$W_B = C\rho\varepsilon^2 R^2 L \tag{D1}$$

where C is a constant.

For the LMSC/SEP type design the constant has been determined as

$$C = 37.7$$

Thus

$$W_B = 37.7 \rho\varepsilon^2 R^2 L \tag{D2}$$

and the $\overline{EI}$ of the boom has been expressed as a function of the boom radius and the coiling strain

$$\overline{EI} = 1.5 \pi ER^4 \varepsilon^2 \tag{D3}$$

The derivation of Eq. (D3) assumes circular solid longerons.

Combining Equations (D2) and (D3) by eliminating ε

$$W_B = \frac{8.0 \rho L \overline{EI}}{ER^2} \tag{D4}$$

or with $\rho = 0.071$ pci and $E = 7.1 \times 10^6$ psi

$$W_B = 7.887 \times 10^{-8} \frac{\overline{EI}\ L}{R^2} \tag{D5}$$

Canister Height

As before the expression for canister height, H_{can}, will be assumed to be divided into three parts as follows:

$$H_{can} = H_{stow} + H_{trans} + H_{mech} \tag{D6}$$

where

H_{stow} = Length required for stowing the retracted boom

H_{trans} = Transitional length of body, between fully coiled and fully deployed configurations

H_{mech} = Length required for the three-threaded nut deployment mechanism

Previously the equation for H_{stow} was derived for a constant strain. The equation for H_{stow} will now be re-written expressing the stowage length as a function of boom $\overline{EI}$, boom radius R, and boom length L.

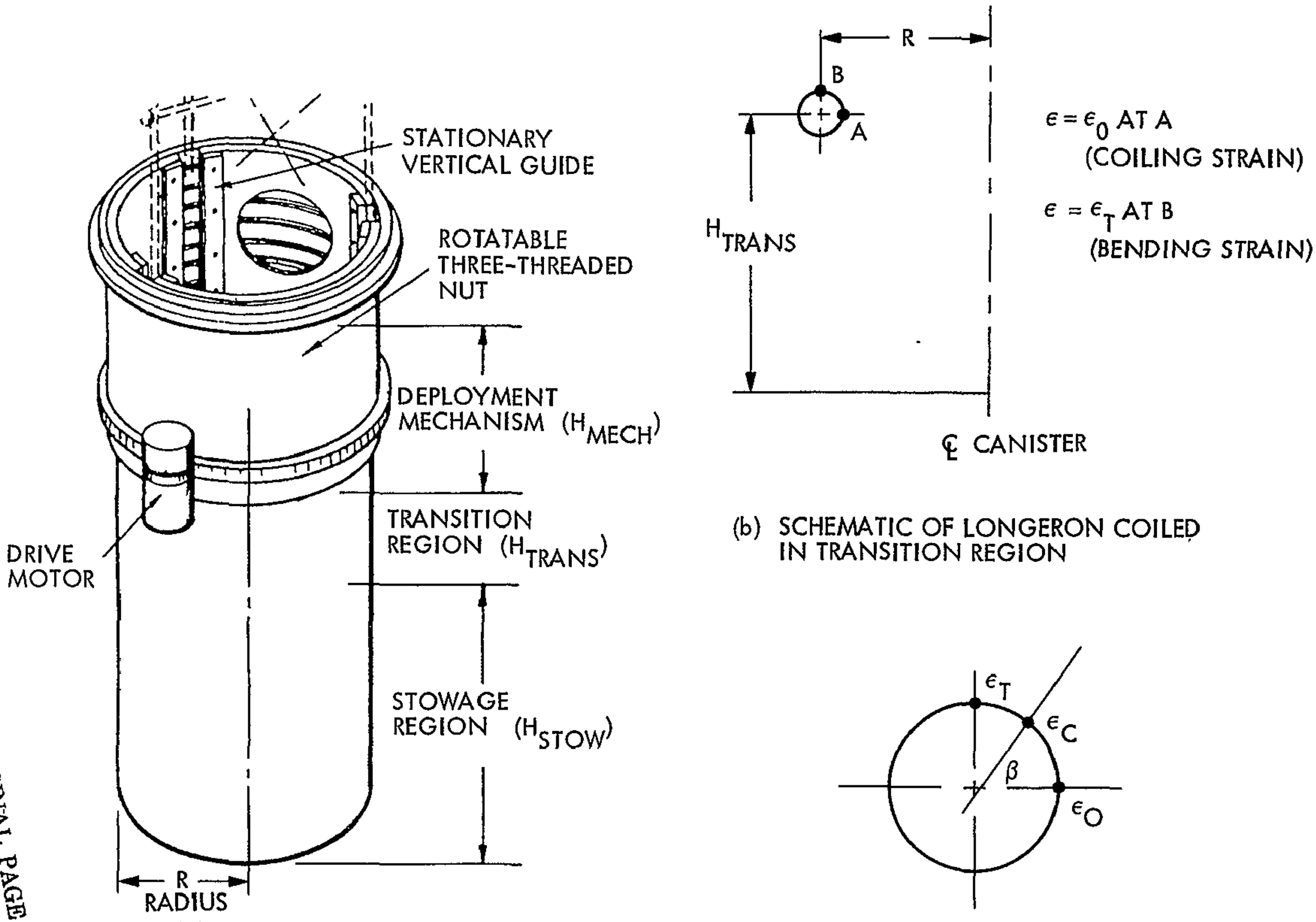
Assume

$$H_{stow} = C \frac{3L}{\pi} \varepsilon \tag{D7}$$

$$C\varepsilon = \varepsilon + 0.008 \tag{D8}$$

for the LMSC/SEP design

$$\varepsilon = 0.015$$



(a) NOMENCLATURE

(b) SCHEMATIC OF LONGERON COILED IN TRANSITION REGION

(c) CROSS SECTION OF LONGERON

Figure D1.

and C can be determined to be

$$C = 1.533$$

Thus

$$H_{stow} = 1.464\ L\varepsilon \tag{D9}$$

But from (D3)

$$\varepsilon = \frac{1}{R^2} \sqrt{\frac{\overline{EI}}{1.5\ \pi\ E}} \tag{D10}$$

Thus

$$H_{stow} = \frac{0.6744\ L}{R^2} \sqrt{\frac{\overline{EI}}{E}} \tag{D11}$$

Next an expression for H_{trans} as a function of boom $\overline{EI}$ and boom radius R will be obtained.

In the transition stage the longerons are stressed due to coiling and transitional bending. These stresses occur in orthogonal planes. The transmission length is determined by the maximum allowable working strain. From the LMSC/SEP design it has been determined empirically that

$$H_{trans} = 1.8\ R \tag{D12}$$

For a coiling strain $\varepsilon_0 = 0.015$. This relationship is empirical and is based on the assumption of multiple extension/retraction cycling. The cross-section of the stressed longeron in the transition stage is shown in Figure D1.

$$\varepsilon_C = \varepsilon_T \sin\beta + \varepsilon_0 \cos\beta \tag{D13}$$

but

$$\varepsilon_0 = \frac{d}{2R} \tag{D14}$$

$$\varepsilon_T = \frac{d}{2\ H_{trans}} \tag{D15}$$

$$\varepsilon_C = \varepsilon_0 \left(\cos\ \beta + \frac{R}{H_{trans}} \sin\ \beta\right) \tag{D16}$$

For $\varepsilon_0 = 0.015$ and $H_{trans} = 1.8\ R$.

The combined maximum strain occurs at

$$\beta = 29° \qquad \varepsilon_{max} = 0.01716$$

Thus Eq. (D16) can be rewritten

$$\frac{\varepsilon_c}{\varepsilon_0} = \cos\ \beta + \frac{R}{H_{trans}} \sin\ \beta \tag{D17}$$

$$\beta = \tan^{-1} \frac{R}{H_{trans}} \tag{D18}$$

$$\sin\ \beta = \frac{R}{H_t} \cos\ \beta \tag{D19}$$

Equation (17) can then be rewritten

$$\frac{\varepsilon_c}{\varepsilon_0} = \cos \left(\tan^{-1} \frac{R}{H_{trans}}\right) \left[1 + \left(\frac{R}{H_{trans}}\right)^2\right] \tag{D20}$$

Introduce approximations through series expansion

$$\tan^{-1} \frac{R}{H_{trans}} \approx \frac{R}{H_{trans}} \left[1 - \frac{1}{3}\left(\frac{R}{H_{trans}}\right)^2\right] \tag{D21}$$

Let

$$\left(\frac{R}{H_{trans}}\right)^2 = x$$

$$1.144 = (1 + x) \cos\left[\sqrt{x}\ (1 - \frac{1}{3} x)\right]$$

$$\cos y \approx 1 - \frac{y^2}{2} \tag{D22}$$

$$1.144 = \left[1 - \frac{x}{2}\ (1 - \frac{x}{3})^2\right] (1 + x) \tag{D23}$$

Expanding and dropping the higher order terms

$$\frac{\varepsilon_c}{\varepsilon_0} \approx 1 + \frac{x}{2} \tag{D24}$$

$$\frac{\varepsilon_c}{\varepsilon_0} \approx 1 + \frac{1}{2}\left(\frac{R}{H_{trans}}\right)^2 \tag{D25}$$

$$\frac{\varepsilon_c - \varepsilon_0}{\varepsilon_0} = \frac{1}{2}\left(\frac{R}{H_{trans}}\right)^2 \tag{D26}$$

$$\left(\frac{H_{trans}}{R}\right)^2 = \frac{\varepsilon_0}{2(\varepsilon_c - \varepsilon_0)} \tag{D27}$$

$$\frac{H_{trans}}{R} = \frac{1}{\sqrt{2\left(\frac{\varepsilon_c}{\varepsilon_0} - 1\right)}} \tag{D28}$$

From the SEP design, $\varepsilon_c = 0.0172$, and from Eq. (D10)

$$\varepsilon_0 = \frac{1}{R^2}\sqrt{\frac{\overline{EI}}{1.5\ \pi\ E}}$$

So,

$$H_{trans} = \frac{R}{\sqrt{2\left(0.0172\ R^2\ \sqrt{\frac{1.5\ \pi\ E}{\overline{EI}}}\ -1\right)}} \tag{D29}$$

The length for the mechanism H_{mech}

$$H_{mech} = 1.5\ R\left(\frac{\ell}{1.25\ R}\right) \tag{D30}$$

where ℓ is the batten spacing, typically

$$\ell = 1.25\ R$$

Hence the total canister height is

$$H_{can} = \frac{0.6755\ L}{R^2}\sqrt{\frac{\overline{EI}}{E}} + \frac{R}{\sqrt{2\left(0.0172\ R^2\ \sqrt{\frac{1.5\ \pi\ E}{\overline{EI}}}\ -1\right)}} + 1.5\ R\left(\frac{\ell}{1.25\ R}\right) \tag{D31}$$

Canister Weight

As before the canister weight

$$W_{can} = W_{stow} + W_{trans} + W_{mech} \tag{D32}$$

where

W_{stow} = weight of cylinder in which boom stows

W_{trans} = weight of cylinder and tracks in the transition region

W_{mech} = weight of deployment mechanism, including nut, guides, bearings, motors and base.

For the SEP design

$$W_{stow} = 5.01 \text{ lb}$$

$$W_{trans} = 3.9 \text{ lb}$$

$$W_{mech} = 24.1 \text{ lb}$$

$$W_{can} = 33.7 \text{ lb}$$

Assume that

$$W_{stow} = C_1 H_{stow} R$$

$$W_{stow} = C_1 \frac{0.6744 L}{R} \sqrt{\frac{\overline{EI}}{E}}$$

$$C_1 = 0.0246$$

or

$$W_{stow} = \frac{0.01661}{R} \sqrt{\frac{\overline{EI}}{E}} \tag{D33}$$

$$W_{trans} = C_2 H_{trans} R = \frac{C_2 R^2}{\sqrt{2\left(0.0172 R^2 \sqrt{\frac{1.5 \pi E}{\overline{EI}}} - 1\right)}}$$

From SEP data with $W_{trans} = 3.9$ lb

$$C_2 = 0.0407$$

then

$$W_{trans} = \frac{0.0407 R^2}{\sqrt{2\left(0.0172 R^2 \sqrt{\frac{1.5 \pi E}{\overline{EI}}} - 1\right)}} \tag{D34}$$

$$W_{mech} = C_2 R^2$$

For SEP

$$W_{mech} = 24.8 \text{ lb}$$

$$C_3 = 0.478$$

$$W_{mech} = 0.478 \, R^2 \tag{D35}$$

and the canister weight

$$W_{can} = \frac{0.01661}{R}\sqrt{\frac{\overline{EI}}{E}} + \frac{0.0407 \, R^2}{\sqrt{2\left(0.0172 \, R^2 \sqrt{\frac{1.5 \, \pi \, E}{\overline{EI}}} - 1\right)}} + 0.478 \, R^2 \tag{D36}$$

System Weight

The system or boom plus canister weight, W_s, is then

$$W_s = 7.887 \times 10^{-8} \frac{\overline{EI} \, L}{R^2} + \frac{0.01661}{R}\sqrt{\frac{\overline{EI}}{E}} + \frac{0.0407 \, R^2}{\sqrt{2\left(0.0172 \, R^2 \sqrt{\frac{1.5 \, \pi \, E}{\overline{EI}}} - 1\right)}} + 0.478 \, R^2 \tag{D37}$$

or with $E = 7.1 \times 10^6 \text{ lb/in}^2$

$$W_s = 7.887 \times 10^{-8} \frac{\overline{EI} \, L}{R^2} + 6.233 \times 10^{-6} \frac{\sqrt{\overline{EI}}}{R} + \frac{0.0407 \, R^2}{\sqrt{2\left(99.49 \frac{R^2}{\sqrt{\overline{EI}}} - 1\right)}} + 0.478 \, R^2$$

To minimize system weight W_s for given $\overline{EI}$ and L must find R from Eq. (D38).

Data Plots

Equation (D38) has been programmed to minimize W_s with respect to R for a given L and $\overline{EI}$. Figure D2 shows a plot of R vs $\overline{EI}$ for constant boom length, L. The same data is replotted as R vs boom length L for constant $\overline{EI}$ in Figure D3.

The boom weight per unit length for the minimum system weight design from Equation (D5) is plotted in Figures (D4) and (D5). Several plots are required since the weight is a function of both the boom stiffness $\overline{EI}$ and the boom length, L. These data are equivalent to those shown in Figure 3 of the original report AECR 7821/115.

Figures (D6) and (D7) show the canister length, H_c, for various combinations of boom length and boom stiffness from Equation (D31). The corresponding data for canister weight obtained from Equation (D34) are plotted in Figures (D8) and (D9).

Application of Minimum System Weight Data to GE Rollout Design Concepts

The equations developed above are now applied to the GE rollout design concepts. Two data points are available.

(a) 10 kw/wing

Boom $\overline{EI}$ = 1.85 x 10^5 lb-in^2, length = 677 inches

Boom radius = 2.5 in. Boom wieght 2.3 lb

Canister weight = 7.2 lb

(b) 60 kw/wing

Boom $\overline{EI}$ = 52 x 10 lb-in^2, length 2280 inches

Boom radius = 10 in, Boom weight = 80 lb

Canister weight = 68 lb

Equations (D5), (D36) and (D38) have been examined for the above two data points and the data are plotted in Figures (D10) and (D11). These plots show that the weights quoted for the rollout design are somewhat higher than the weight obtained from the above derivation. Either the GE design did not quite achieve minimum weight or some of the assumptions made in the derivation, such as the small angle approximation of Eqs. (21) and (22) have introduced inconsistencies.

For purposes of the parametric study either a minimum weight approach as outlined above will be adopted or the constants of Equation (D38) can be adjusted to match the GE rollout array data.

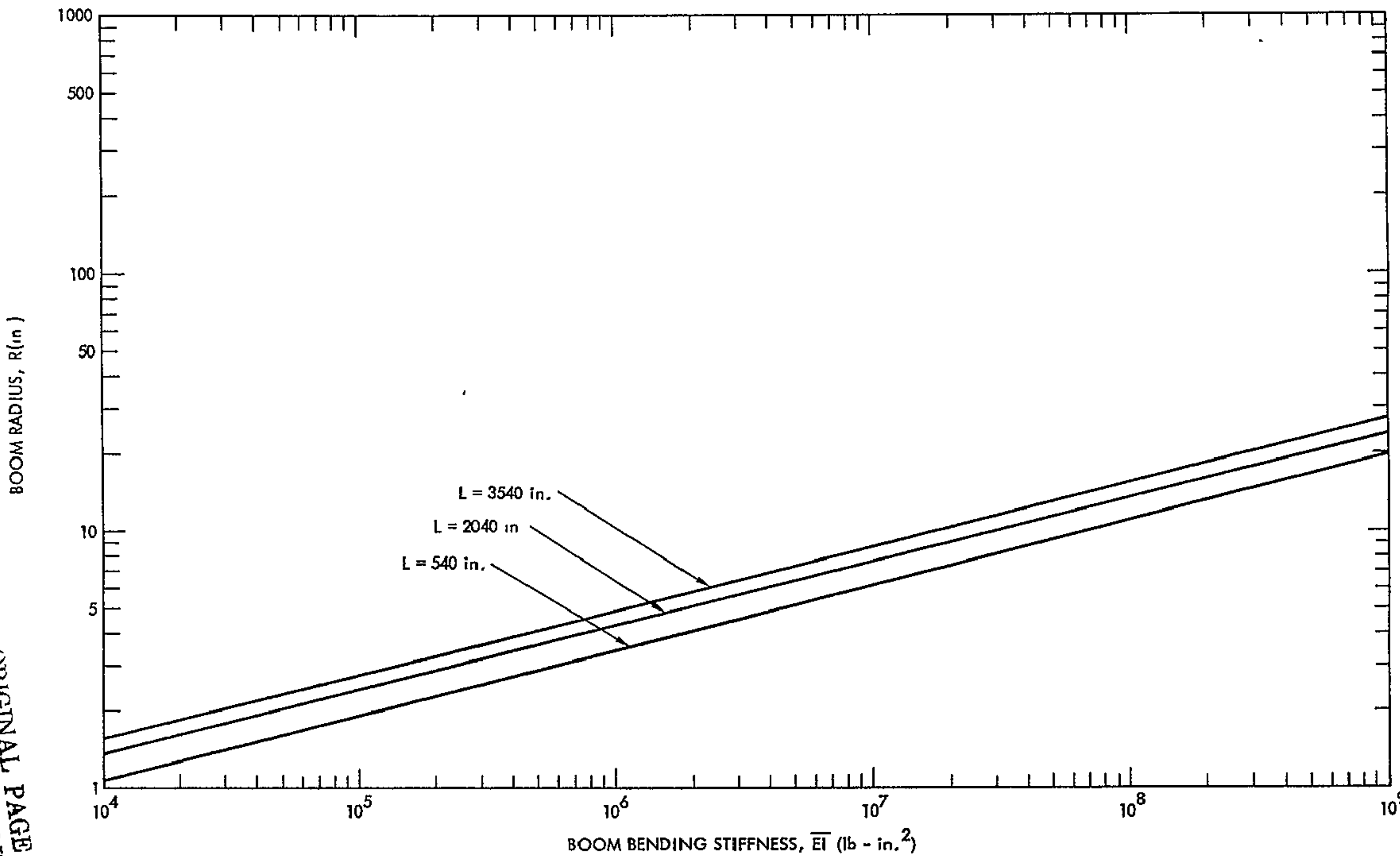


Figure D2(a). Boom Radius Versus Bending Stiffness, Lower Part of Stiffness Range

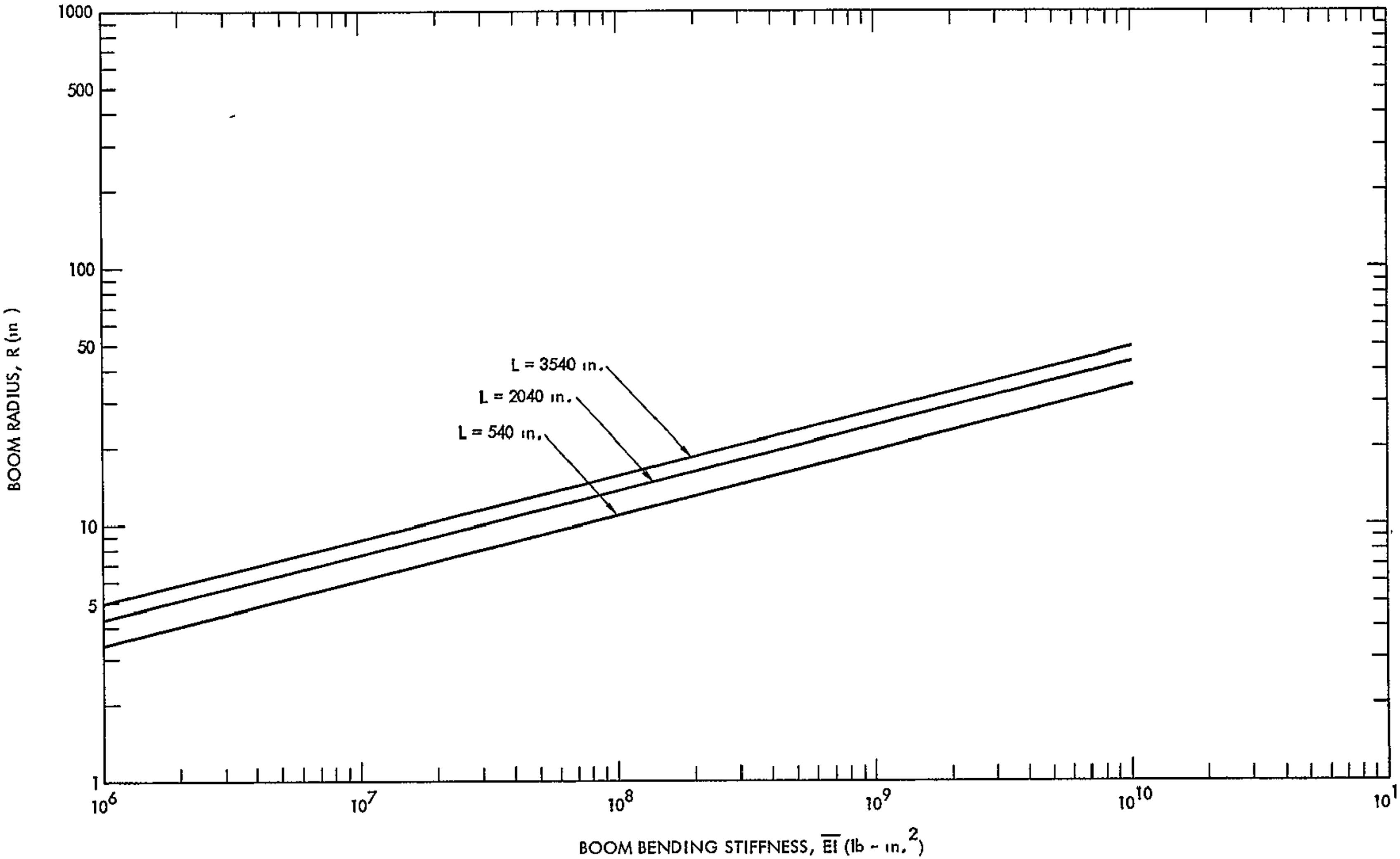


Figure D2(b). Boom Radius Versus Bending Stiffness, Upper Part of Stiffness Range

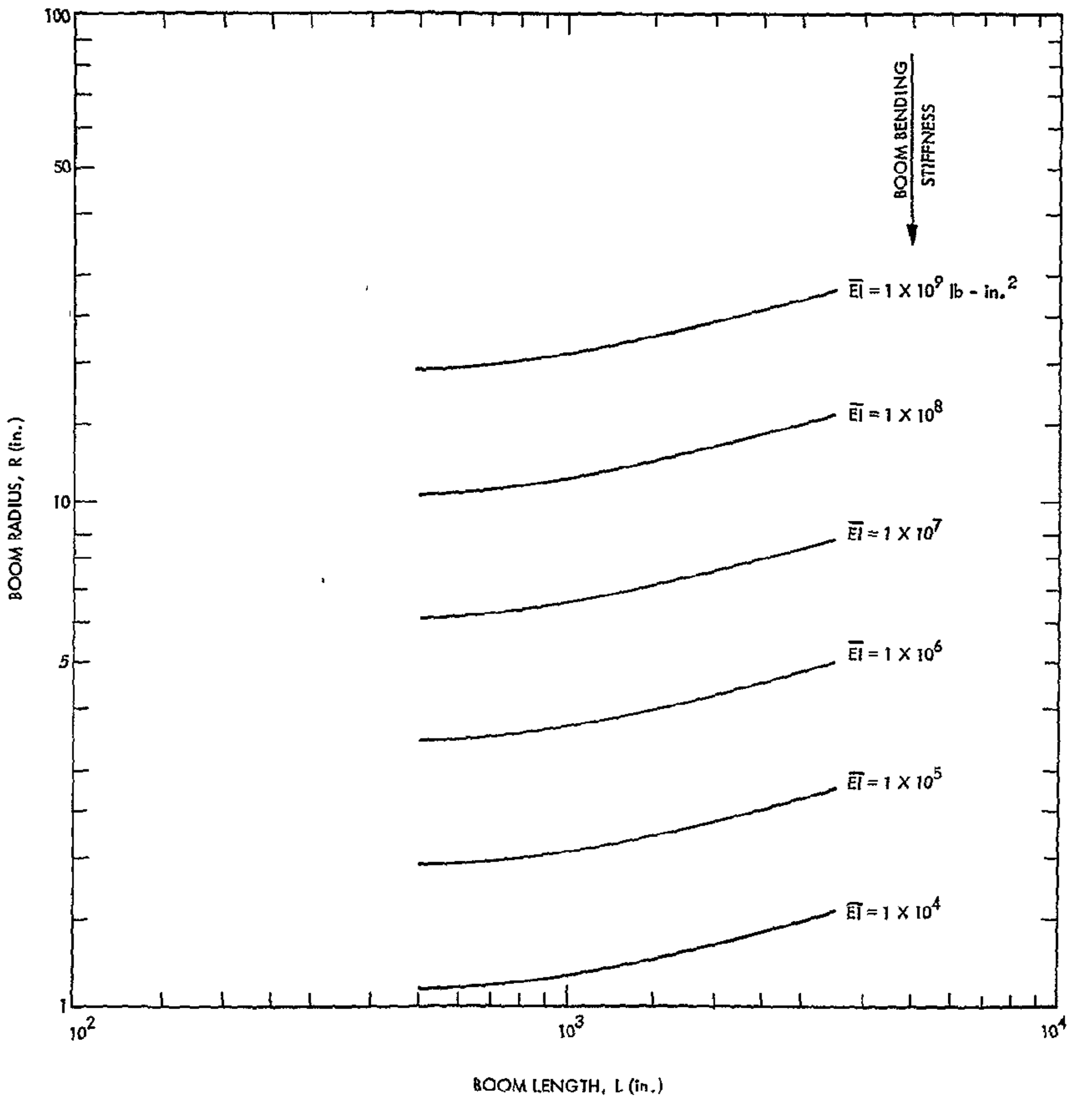


Figure D3. Boom Radius Versus Boom Length

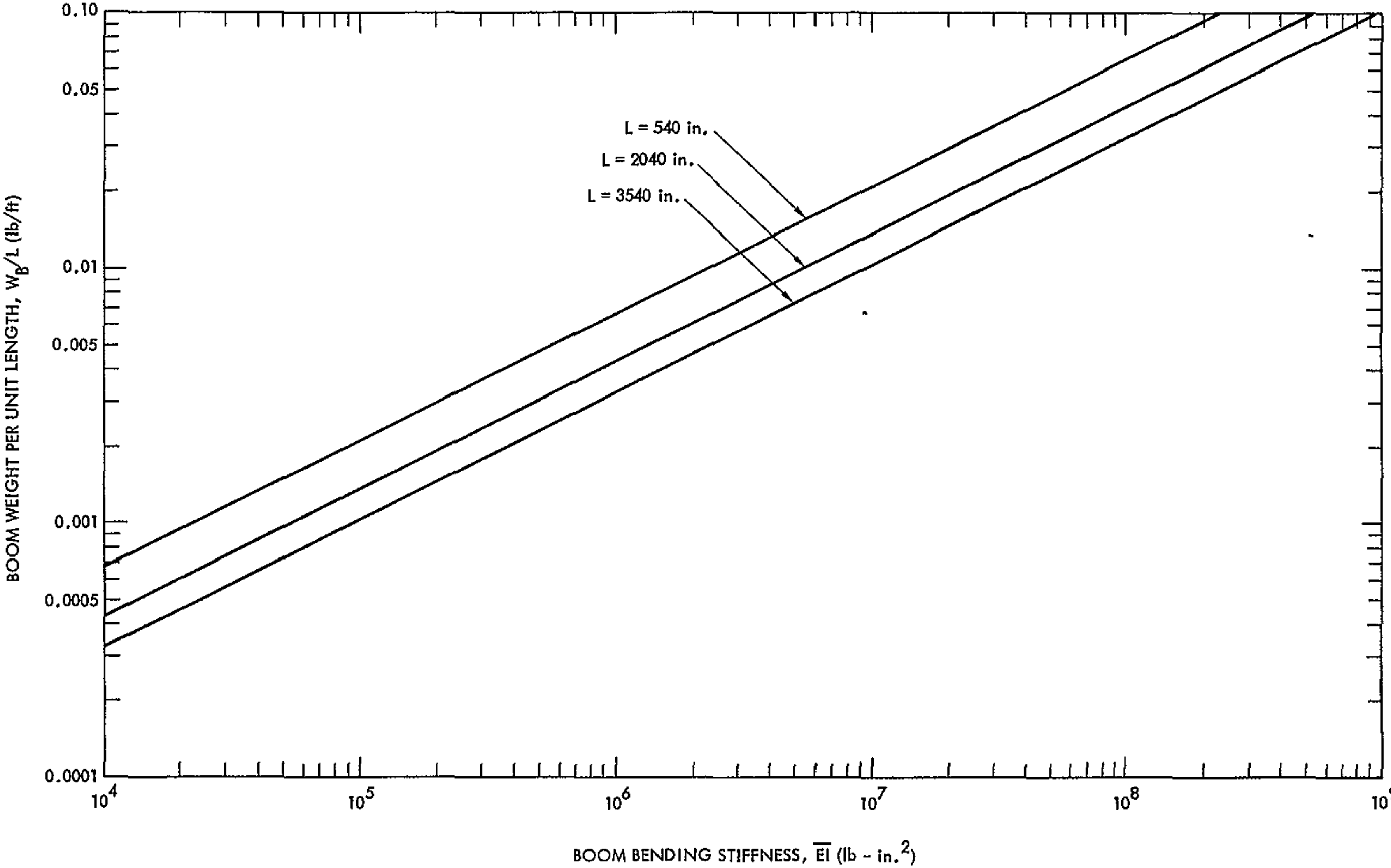


Figure D4(a). Boom Weight Versus Bending Stiffness, Lower Part of Stiffness Range

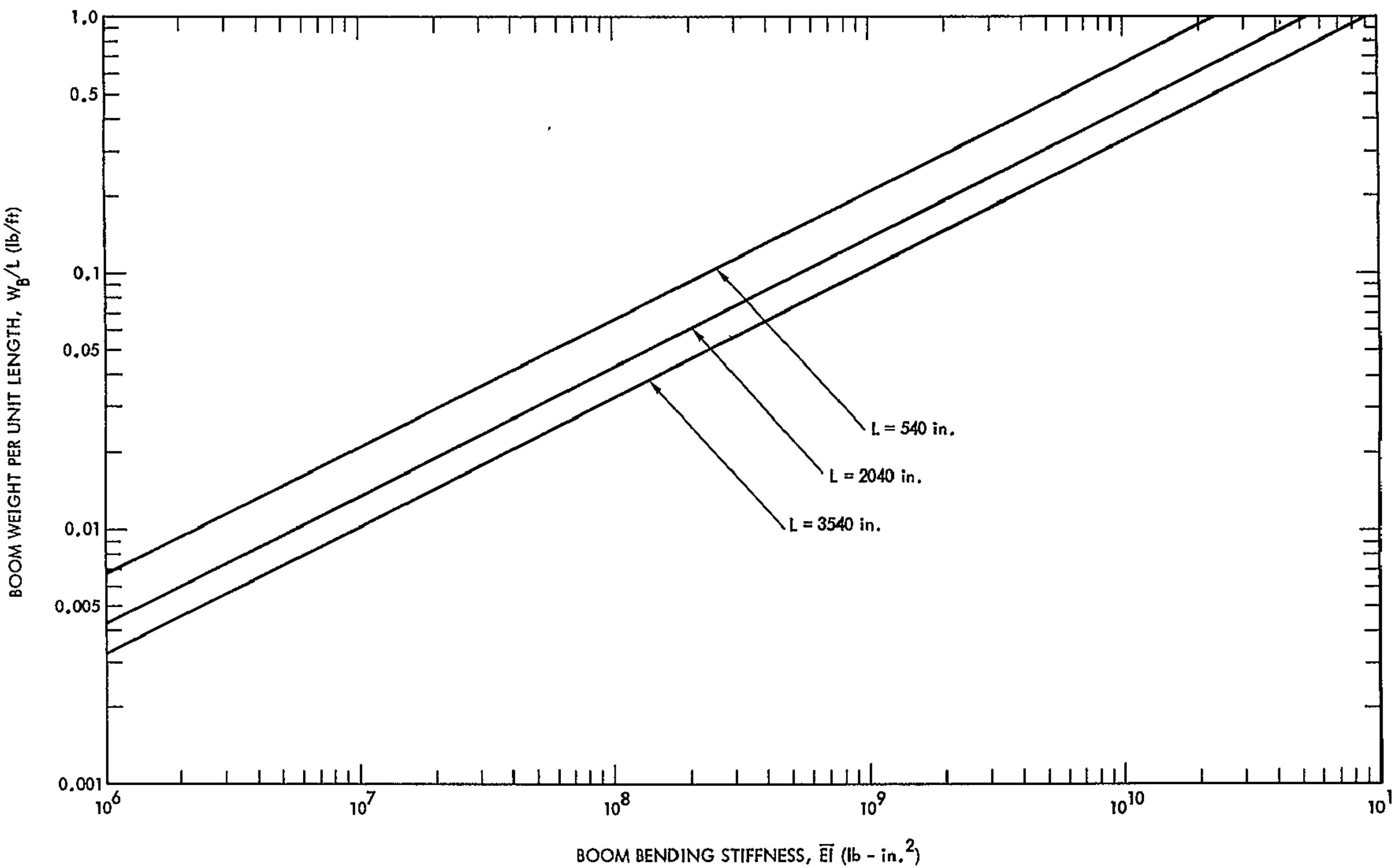


Figure 4(b). Boom Weight Versus Bending Stiffness, Upper Part of Stiffness Range

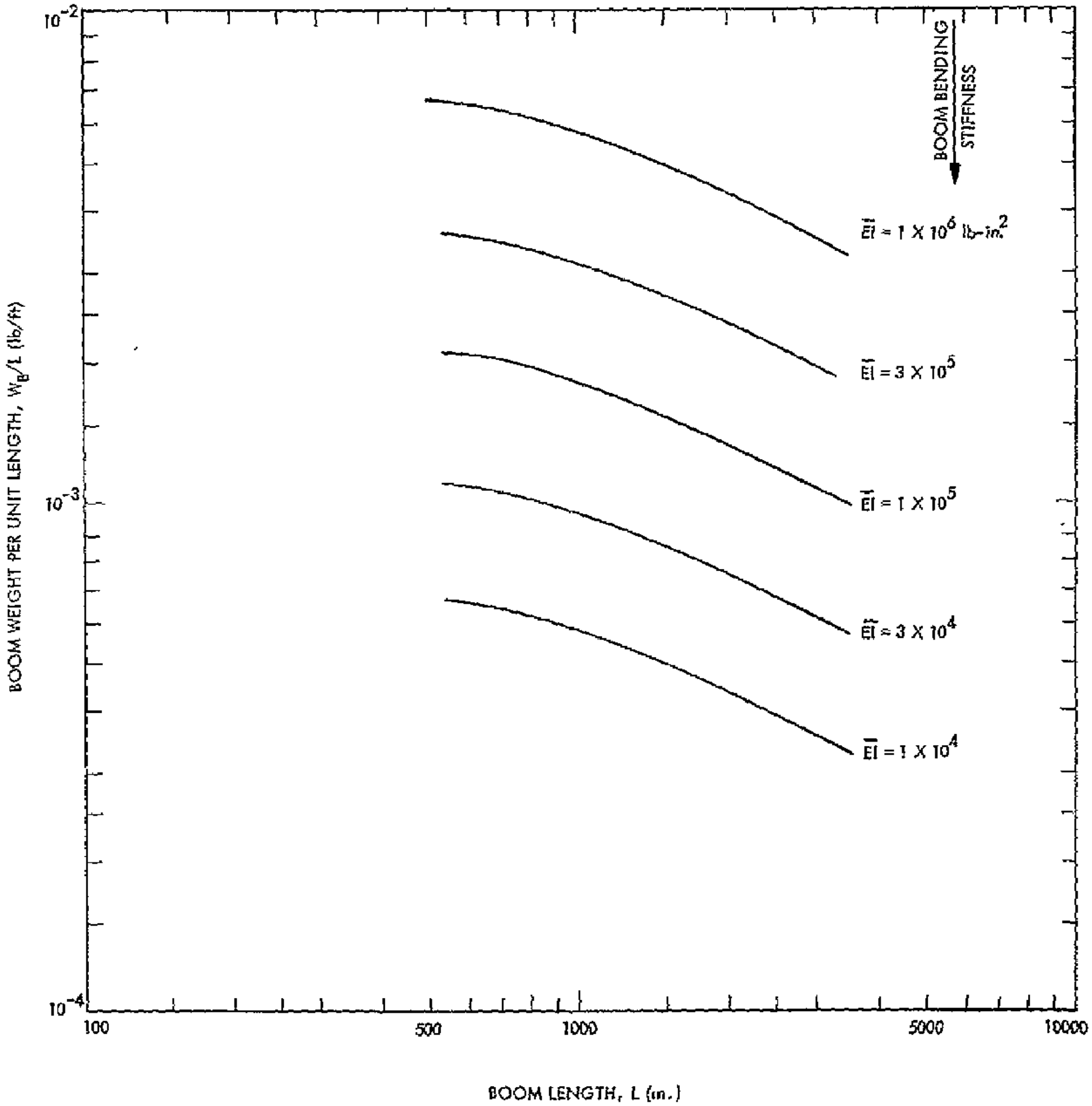


Figure D5(a). Boom Weight Versus Boom Length, Lower Part of Stiffness Range

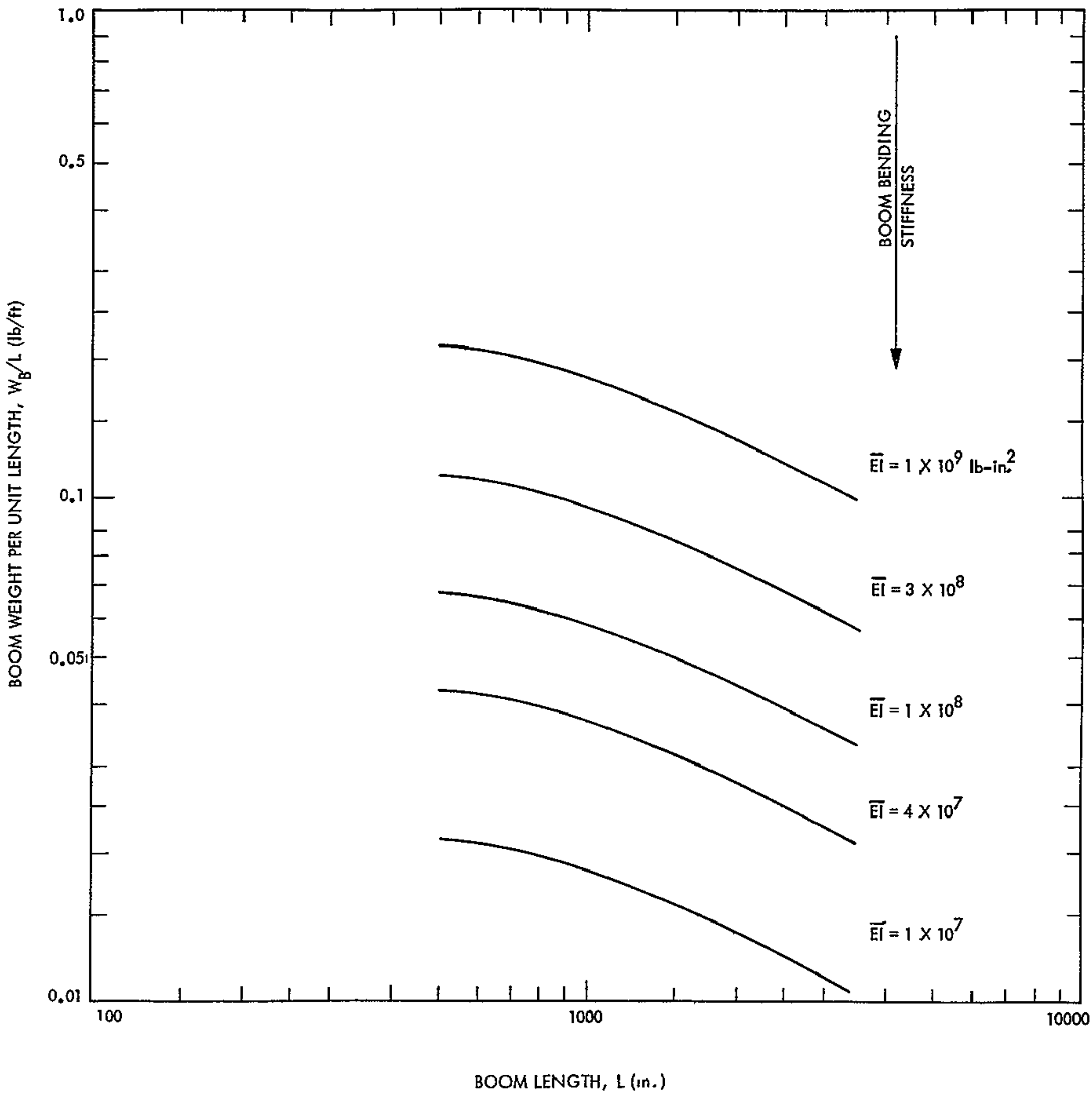


Figure D5(b). Boom Weight Versus Boom Length, Upper Part of Stiffness Range

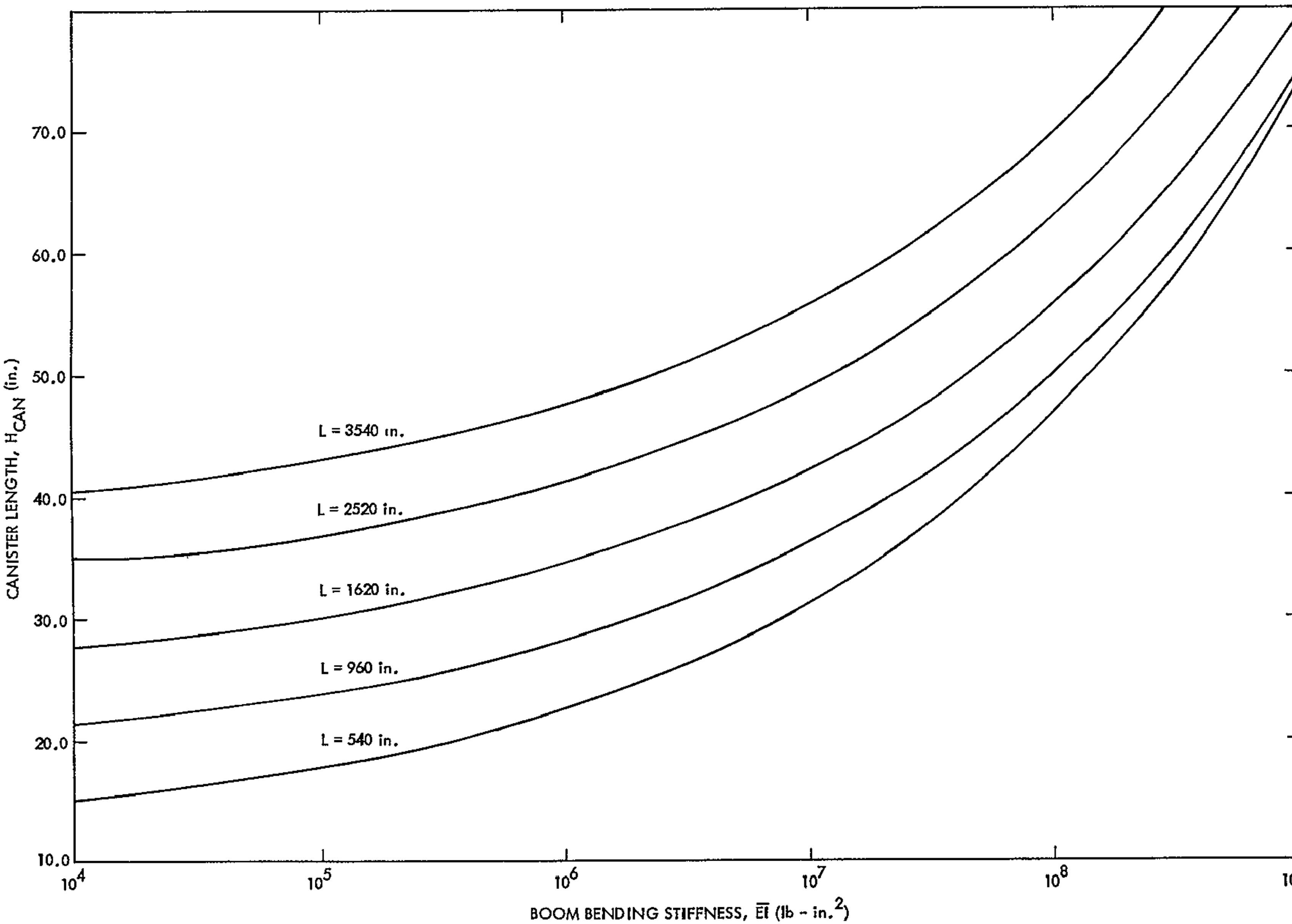


Figure D6(a). Canister Length Versus Bending Stiffness, Lower Length Range

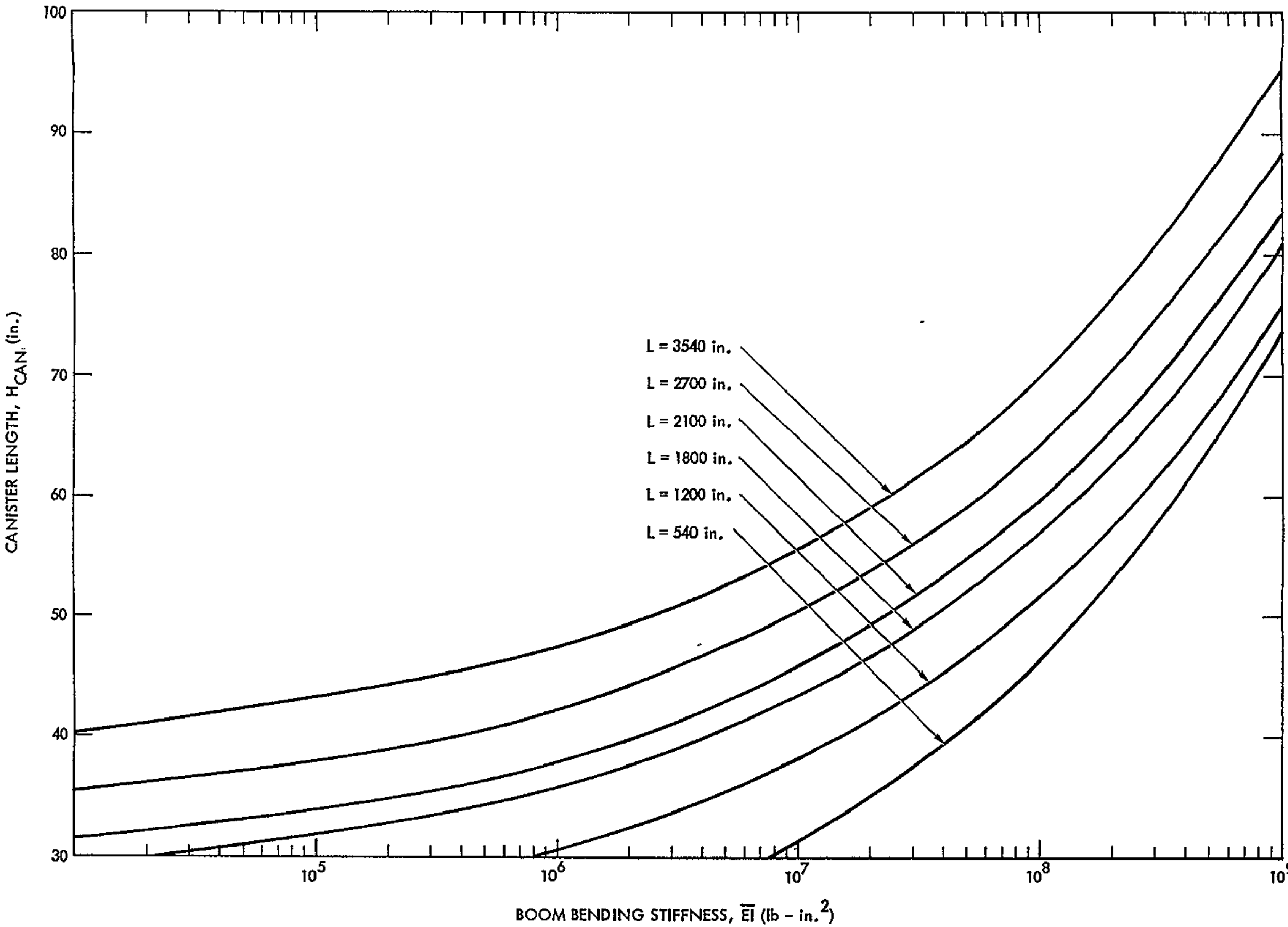


Figure D6(b). Canister Length Versus Bending Stiffness, Upper Length Range

ORIGINAL PAGE IS
OF POOR QUALITY

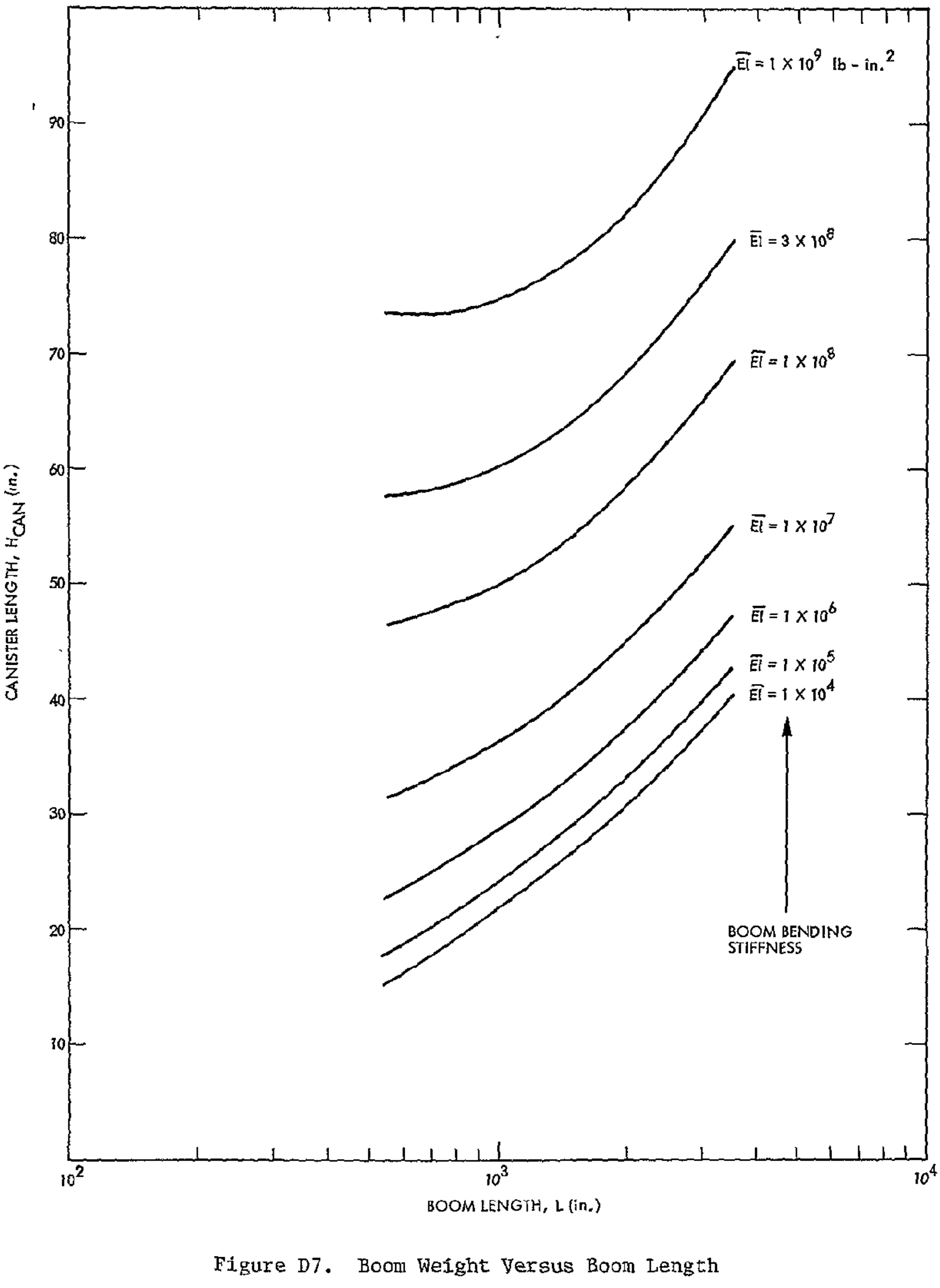


Figure D7. Boom Weight Versus Boom Length

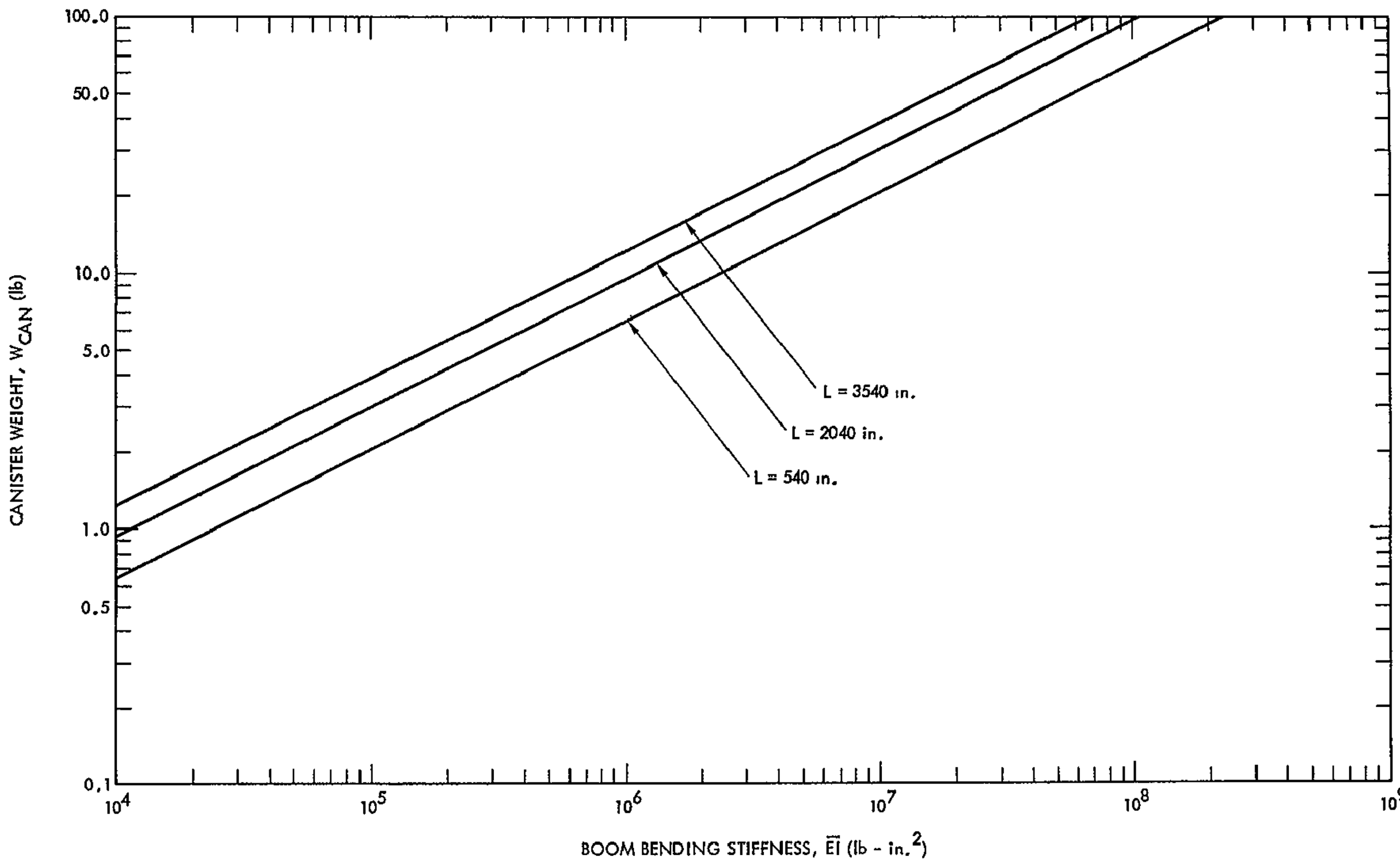


Figure D8(a). Canister Weight Versus Bending Stiffness, Lower Part of Stiffness Range

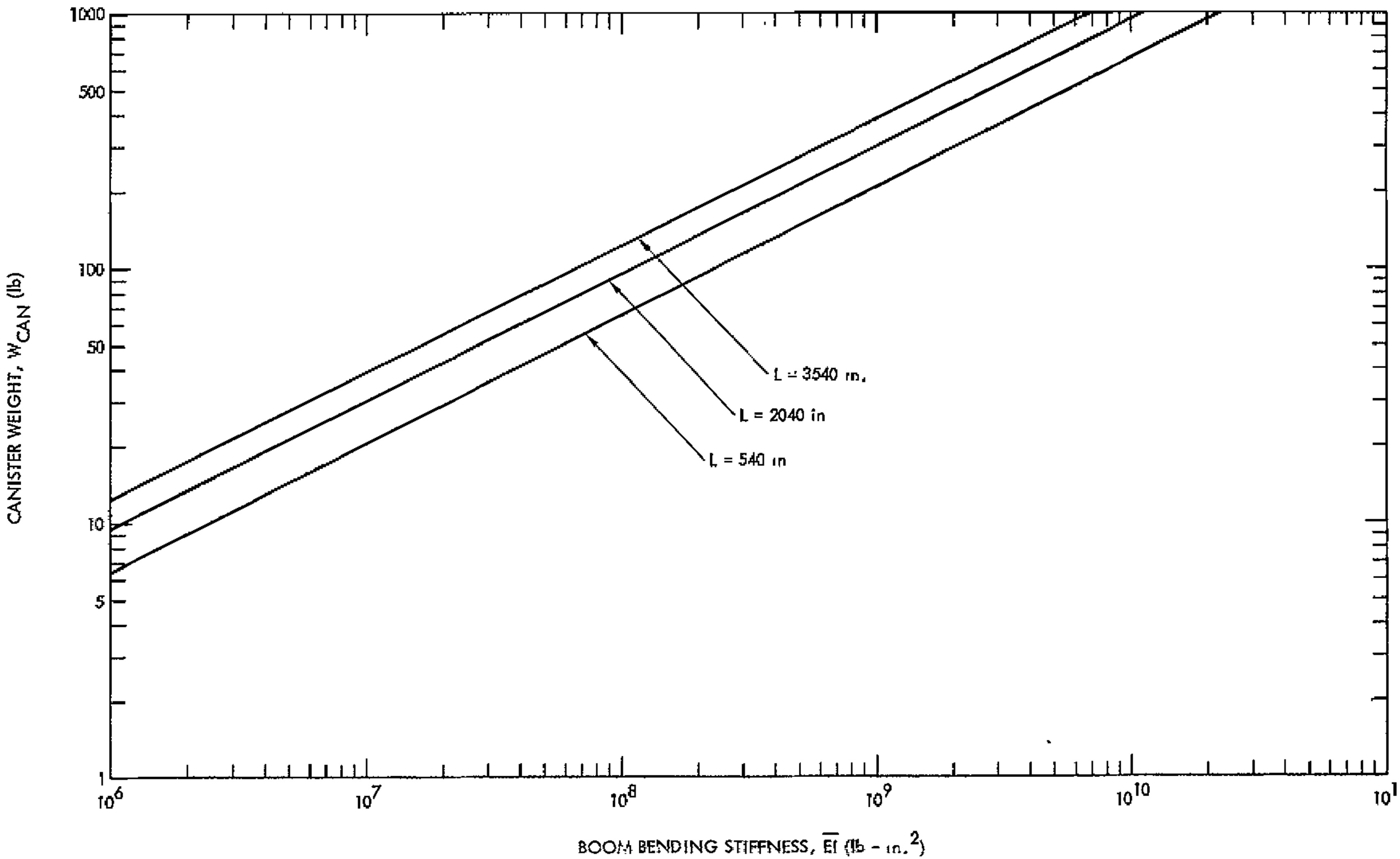


Figure D8(b). Canister Weight Versus Bending Stiffness, Upper Part of Stiffness Range

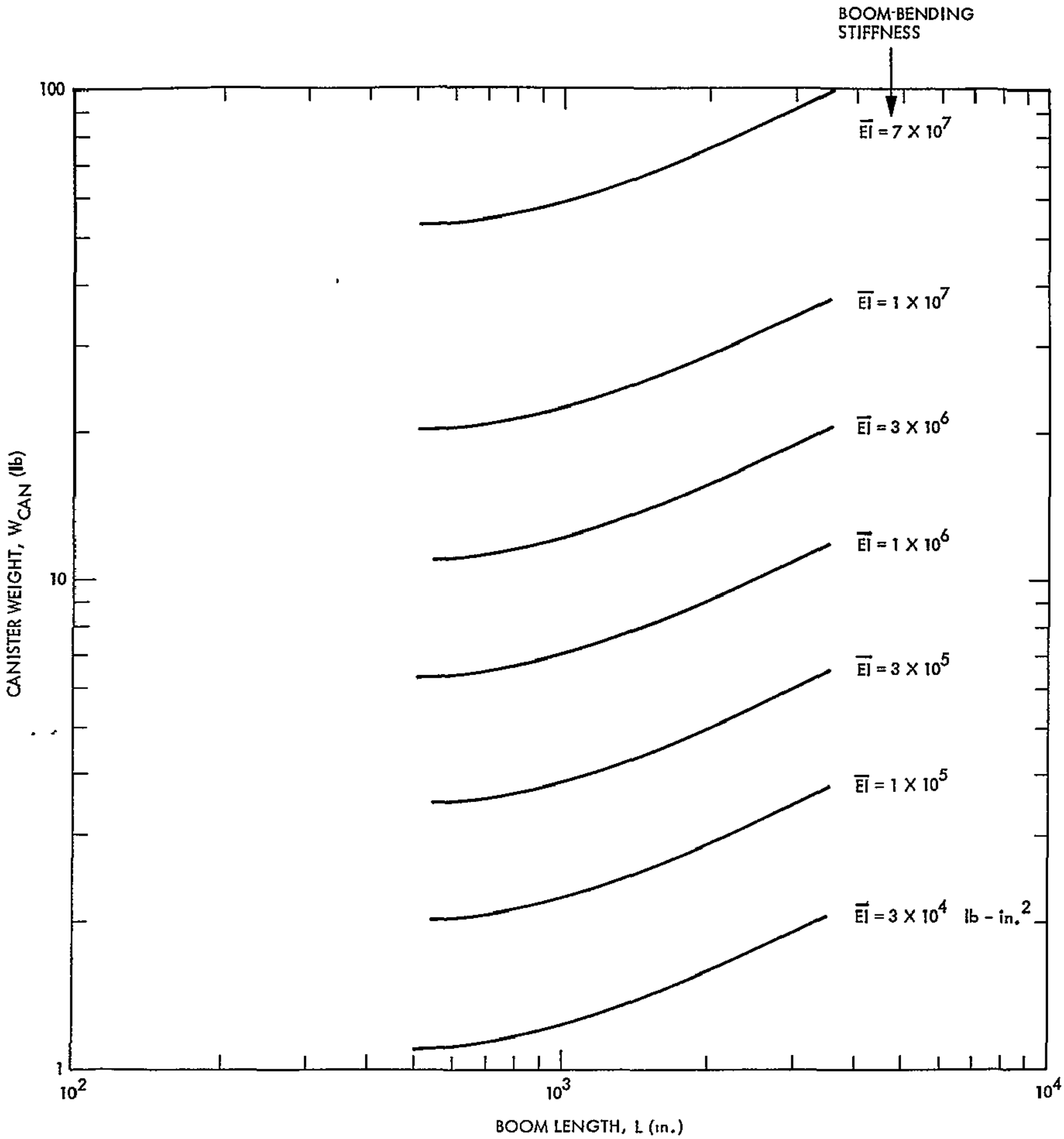


Figure D9(a). Canister Weight Versus Boom Length, Lower Part of Stiffness Range

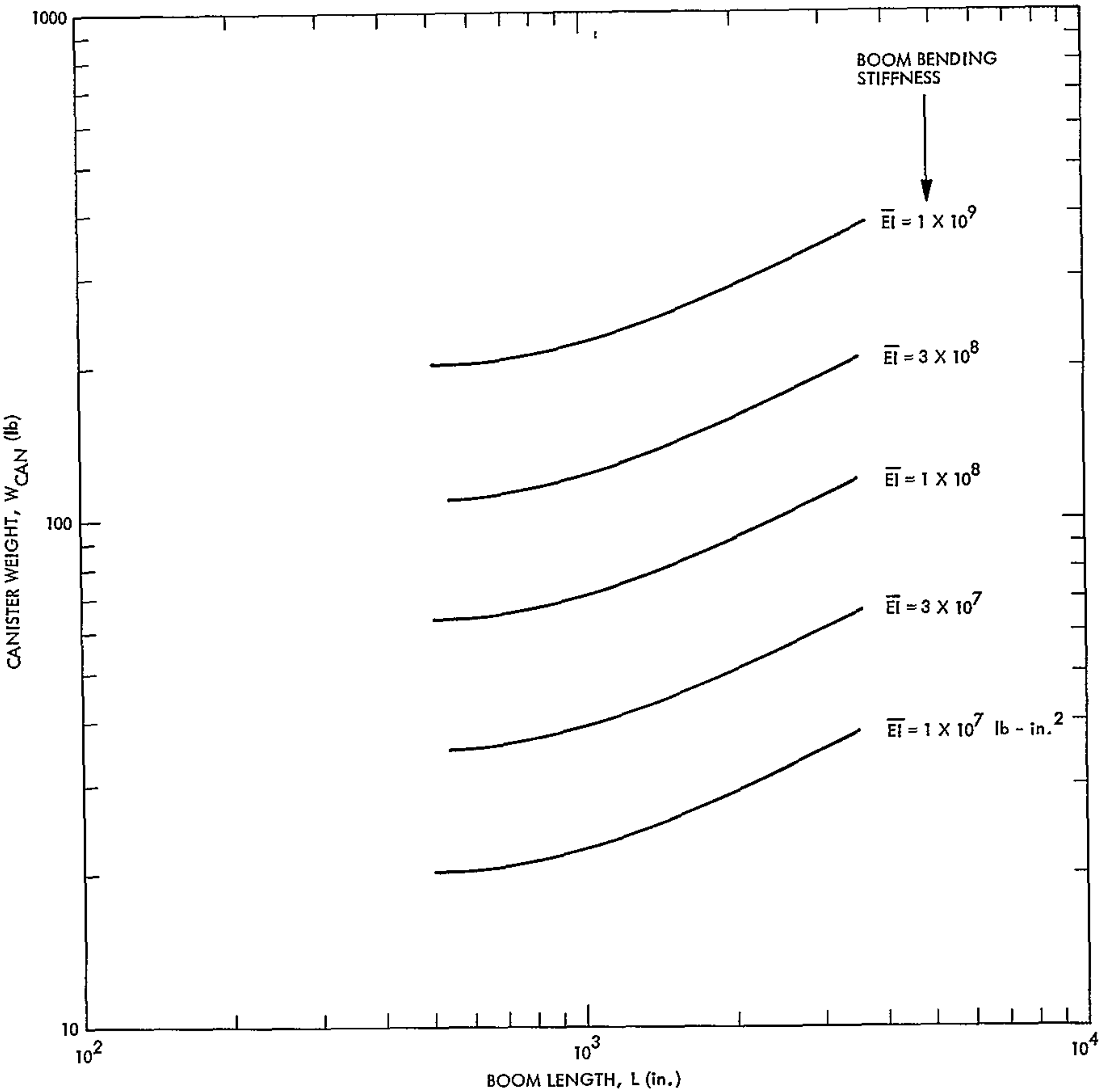


Figure D9(b). Canister Weight Versus Boom Length, Upper Part of Stiffness Range

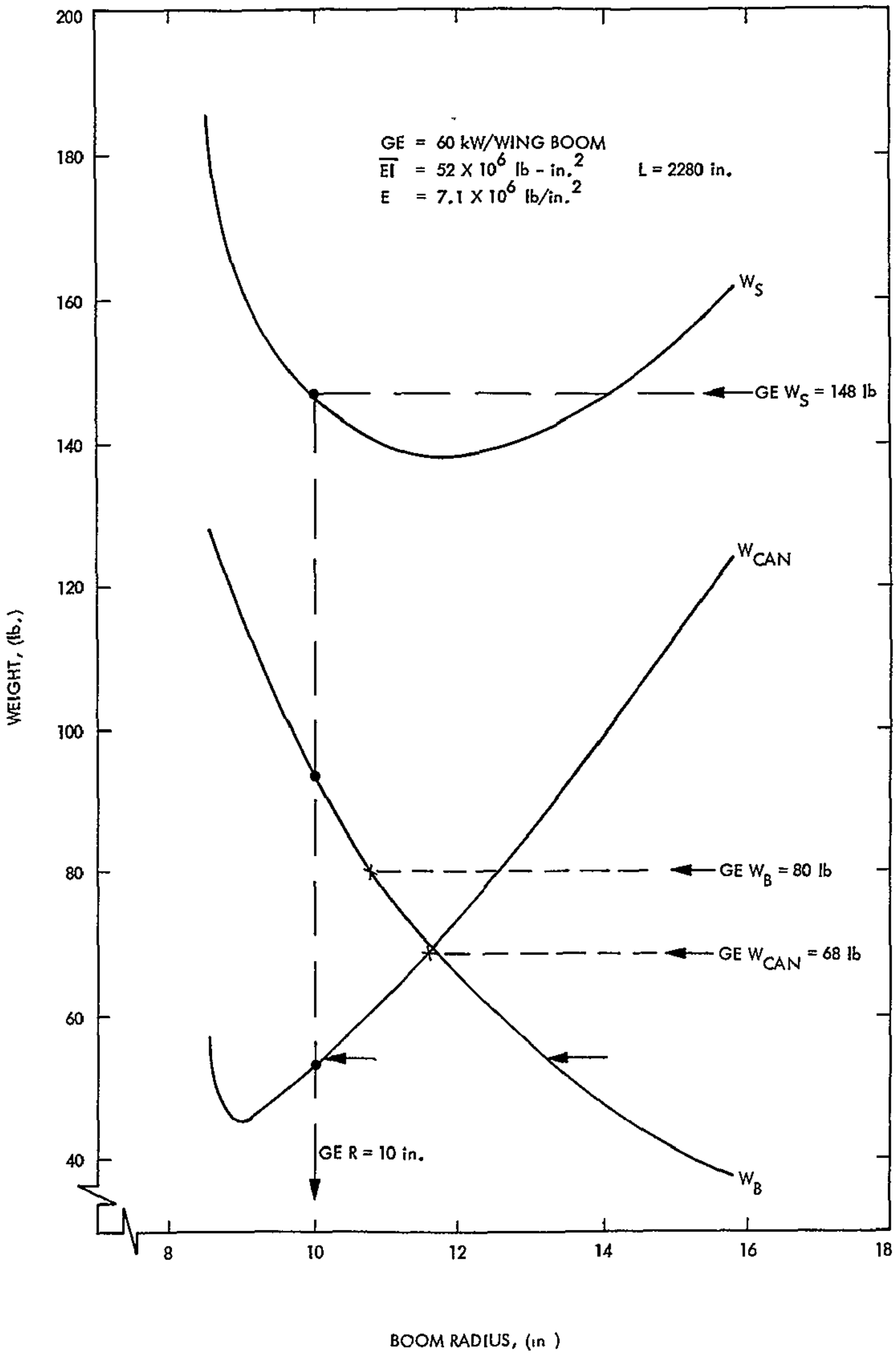


Figure D10. 60 kW/Wing Data

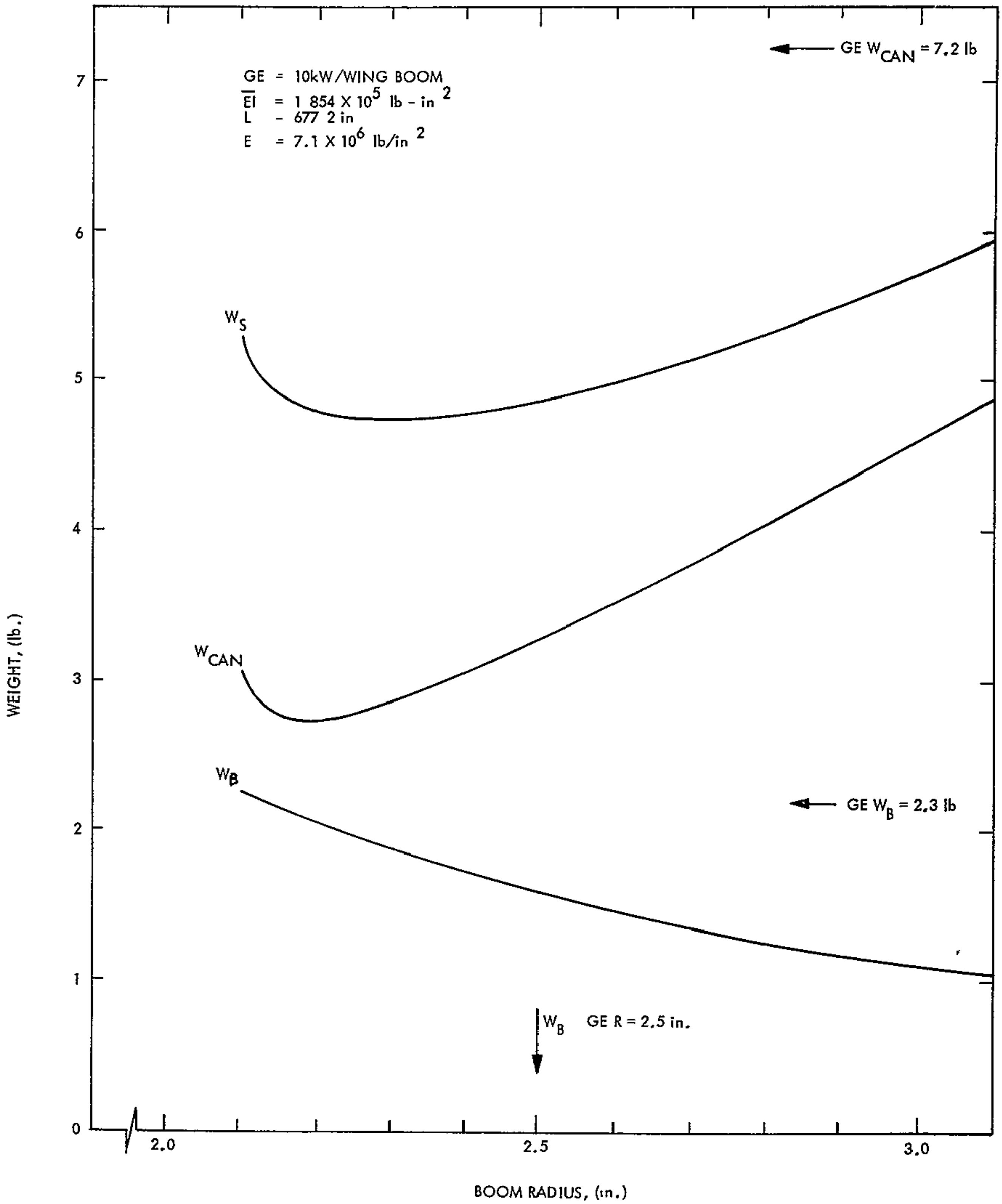


Figure D11. 10 kW/Wing Data

APPENDIX D

SECTION I

PART 3

SCALING EQUATIONS FOR THE WEIGHTS OF THE STRUCTURAL ELEMENTS

APPENDIX D

SECTION I — PART 3

SCALING EQUATIONS FOR THE WEIGHTS OF THE STRUCTURAL ELEMENTS

APPROACH

The scaling equations for the structural elements have been derived using the weight data supplied for the conceptual designs. The weight data for the foldout array was obtained from References 12 and 13. The rollout array weights are contained in References 14 and 15.

In developing the scaling equations it was assumed that the elements were either stress, deflection or buckling critical.

The assumptions used in generating the equations for each of the elements are described as part of the derivation.

The scaling equations for the deployment mast and the associated canister were derived by AEC-Able Engineering Company of Goleta, California and are contained in Part 1 and Part 2 of Section I.

FOLDOUT ARRAY

The foldout array weights are defined for two different types of solar cells. The 12.5 kw/wing array contains heavy cells, 8 mil (200 micron) with a 6 mil (150 micron) cover glass, Reference 12. The 30 kw/wing and 60 kw/wing configurations use 3 mil (75 micron) covers for a nominal 200 Watt/kg, Reference 13.

The heavy solar cell blanket has a nominal power density of 0.0000640 kw/in.^{2} (0.0989 kw/in.^{2}) and a corresponding weight density of 0.00128 lb/in.^{2} (0.895 kg/in.^{2}). The corresponding values for the lightweight solar cell blanket are 0.0000764 kw/in.^{2} (0.118 kw/in.^{2}) and 0.000496 lb/in.^{2} (0.349 kg/in.^{2}).

For the purpose of this study only the heavy solar cells were considered. Thus all the weights of the structural elements for the 30 kw/wing and 60 kw/wing configuration which are functions of the blanket weight were resized for the heavy solar cells.

NOMENCLATURE

A	Cross Sectional Area, in.^{2}
C_i	Constant

ℓ_B	Blanket Length, in.
ℓ_C	Container Length, in.
ℓ_e	Length of Articulating Outboard Container, in.
I	Section Moment of Inertia, $in.^4$
P_{ave}	Average pressure exerted by the blanket on the container, $lb/in.^2$
t	thickness, in.
w_B	blanket width, in.
W_B	blanket weights, lb
W_{BH}	Box Hinge Structure Weight, lb
W_C	Box Cover Structure Weight, lb
W_{CC}	Container Weight, lb
W_{CT}	Box Cover Weight, lb
W_F	Tip Fitting Weight, lb
W_L	Load Distribution Structure Weight, lb
W_{SS}	Support Strut Weight, lb
γ_A	Blanket Area Density, $lb/in.^2$
ρ	Weight Density, $lb/in.^3$
θ	Beam Rotation, Radians

DERIVATION OF SCALING EQUATIONS

1. Box Cover

The box cover weight quoted in Reference 12 is divided into two basic elements: (1) the cover structure and (2) preload distribution structure. The function of the cover is to restrain the solar cell blanket during the launch phase. Thus the cover is designed by launch loads which are assumed to be proportional to the blanket weight.

The box cover for the 12.5 kw/wing configuration is designed for 4 latch points and a fiberglass preload distribution structure, see Figure D12. The quoted weight is 5.19 lb (2.36 kg) without contingency. The preload is 1.5 psi (1.03 N/cm^2) average. A more efficient preload distribution structure can be achieved by increasing the number of latch points. This results in some slight increase in mechanism weight, see Part 4. The latch points have been assumed spaced at one cover width, 16.5 in. (41.9 cm) apart. For the average pressure of 1.5 psi (1.03 N/cm^2) the preload distribution structure weight is estimated at 2.64 lb (1.20 kg). This weight is based on a backup structure consisting of 1 in. (2.54 cm) deep fiberglass I beams, flange and web thickness of 0.030 in. (0.76 mm).

The scaling equations for the box cover will be developed using the above weight.

The blanket weight will be defined by

$$W_B = \ell_B \, w_B \, \gamma_A \qquad \text{(D39)}$$

The average pressure on the box cover is assumed to be proportional to

$$P_{ave} = C_1 \, \ell_B \, w_B \, \gamma_A \qquad \text{(D40)}$$

using the 12.5 kw/wing data,

$$\ell_B = 1244 \text{ in.}$$

$$w_B = 157 \text{ in.}$$

$$\gamma_A = 0.00128 \text{ lb/in.}^2$$

$$P_{ave} = 1.5 \text{ psi}$$

The proportionally constant

$$C_1 = 0.006$$

$$P_{ave} = 0.006 \, \ell_B \, w_B \, \gamma_A \qquad \text{(D40a)}$$

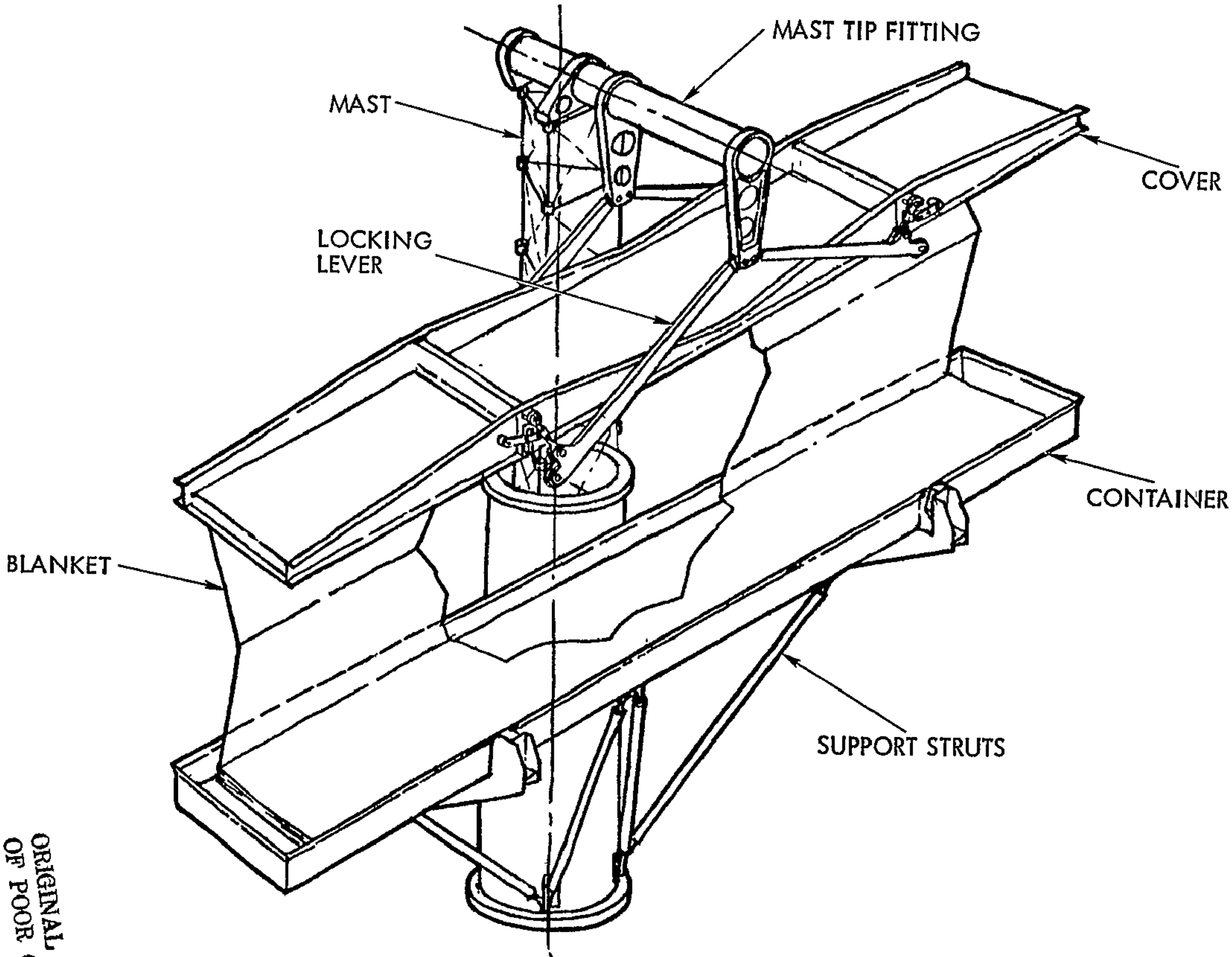


Figure D12. Major Structural Elements for Foldout Design

For the load distribution structure, it will be assumed that only the web and flange thickness will be varied for different loadings. The reinforcement beams have the following properties

$$I \approx 0.33t$$

$$A \approx 2t$$

$$A \approx 6I$$

The weight of the structure is proportional to the area, which for constant bending stress is proportional to the loading, thus

$$W_L = C_2 \, \ell_B \, w_B \, \gamma_A \tag{D41}$$

for

$W_L = 2.64$ lb

$\ell_B = 1244$ in.

$w_B = 157$ in.

$\gamma_A = 0.00128$ lb/in.^{2}

The proportionally constant

$$C_2 = 0.0106$$

$$W_L = 0.0106 \, \ell_B \, w_B \, \gamma_A \tag{D41a}$$

A similar assumption will be made for the basic cover structure. It will be assumed that only the facesheet thickness of the honeycomb will be varied, the honeycomb thickness is held constant at 1 inch (2.54 cm), thus

$$A \approx 4I$$

Here again for a bending stress limited design

$$W_C = C_3 \ell_B w_B \gamma_A \tag{D42}$$

For the 12.5 kw/wing design

$W_C = 7.26$ lb

$\ell_B = 1244$ in.

$w_B = 157$ in.

$\gamma_A = 0.00128$ lb/in.^{2}

$C_3 = 0.029$

$$W_C = 0.029 \ell_B w_B \gamma_A \tag{D42a}$$

For the total box cover weight, combine (D41a) and (D42a)

$$W_{CT} = 0.0396 \ell_B w_B \gamma_A \tag{D43}$$

Equation (D43) can now be used to evaluate the box cover weight for the 30 kw/wing and 60 kw/wing configurations with heavy solar cells. Thus

$$W_{CT} = 19.83 \text{ lb } (9.01 \text{ kg}) \text{ for 30 kw/wing}$$

and

$$W_{CT} = 39.94 \text{ lb } (18.15 \text{ kg}) \text{ for 60 kw/wing}$$

2. Container

The container construction is similar to the box cover, see Figure D12. The main function is to support the blanket during launch. The following weight data is extracted from the conceptual designs for a nominal 160 in. (4.06 m) section

12.5 kw/wing	30 kw/wing	60 kw/wing
Heavy Blanket	Light Blanket	Light Blanket
Unbroken	Unbroken	Broken
22.22 lb (10.1 kg)	12.03 lb (5.47 kg)	19.47 lb (8.85 kg)

The weight for the 30 kw/wing and the 60 kw/wing data from Reference 13 have been adjusted for the support strut weights by subtracting 1.45 lb (0.66 kg) and 2.18 lb (0.99 kg) from the total container weight, respectively.

The assumption is made by LMSC that the weight is proportional to container length. Thus the equations will be written for a 60 inch section.

The container weight is a function of the blanket weight and the box cover. Since the box cover is assumed to be a function of the blanket weight only, the scaling equation for the container weight will be assumed to be of the form

$$W_{CC} = C_4 \, \ell_B \, w_B \, \gamma_A + C_5 \tag{D44}$$

The constants C_4 and C_5 will be determined by matching the unbroken configuration container weights for the 12.5 kw/wing and the 30 kw/wing. For the broken configuration C_5 will be adjusted upward to match the weight of the 60 kw/wing configuration.

Solving Equation (D44) with $W_{CC} = 22.22$ lb, $\ell_B = 1244$ in., $w_B = 157$ in., $\gamma_A = 0.00128$ lb/in.^{2} for the 12.5 kw/wing and with $W_{CC} = 12.03$ lb, $\ell_B = 1250$ in., $w_B = 157$ in., $\gamma_A = 0.000496$ lb/in.^{2} for the 30 kw/wing array, $C_4 = 0.06673$ and $C_5 = 5.53$.

Then for a 160 inch segment of the container $\ell_C \approx w_B$

$$W_{CC} = 10.47 \, \ell_B \, \gamma_A + 5.53 \tag{D45}$$

and assuming a constant weight per inch

$$W_{CC} = 0.0668 \, \ell_B \, w_B \, \gamma_A + 0.0352 \, w_B \tag{D46}$$

for the unbroken array.

For the broken array an additional weight proportional to the container weight will be added to Equation (D46) to account for additional structure due to the discontinuity to match the cover weight quoted for the 60 kw/wing array. Thus for the broken array

$$W_{CC} = 0.0668\ \ell_B\ w_B\ \gamma_A + 0.0577\ w_B \tag{D47}$$

The weight for the container of the 30 kw/wing and 60 kw/wing configurations with heavy solar cells are then estimated as W_{CC} = 44.5 lb (20.2 kg) for 30 kw/wing and W_{CC} = 90.11 lb (40.96 kg) for 60 kw/wing.

3. Mast Tip Fitting

The following data points are available for extrapolating the tip fitting weight for the foldout array, see Figure D12.

	12.5 kw/wing	30 kw/wing	60 kw/wing
Weight, W_F	1.61 lb (0.73 kg)	1.54 lb (0.7 kg)	2.20 lb (1.0 kg)
Blanket Tension, lb	22	3	5
Mast Diameter, in.	14.7	7.0	11.0

Initially it was assumed that the tip fitting is of deflection limited design and hence, proportional to the total blanket tension. This did not result in reasonable scaling laws. It was then assumed that the tip fitting is designed by launch loads and that the 60 kw/wing broken configuration carries additional load.

The scaling method for the fitting weight then parallels that used for the container.

$$W_F = C_6\ \ell_B\ w_B\ \gamma_A + C_7 \tag{D48}$$

solving for the constants in the above equation using the 12.5 kw/wing and 30 kw/wing data,

$$C_6 = 0.00127 \qquad C_7 = 1.290$$

Thus

$$W_F = 0.00127\ \ell_B\ w_B\ \gamma_A + 1.29 \tag{D49}$$

For the unbroken array, and

$$W_F = 0.00127\ \ell_B\ w_B\ \gamma_A + 1.70 \tag{D50}$$

for the broken array.

The tip fitting weights for the 30 kw/wing and 60 kw/wing configuration with heavy blankets can now be estimated using Equation (D49) and (D50).

$$W_F = 1.92 \text{ lb } (0.87 \text{ kg}) \qquad \text{for 30 kw/wing}$$

and

$$W_F = 2.98 \text{ lb } (1.35 \text{ kg}) \qquad \text{for 60 kw/wing}$$

4. Support Struts

The support strut weight for the 12.5 kw/wing configuration is listed in Reference 12. For the 30 kw/wing and 60 kw/wing configurations, the support struts have been included as part of the container weights. LMSC has estimated the support strut weights as follows:

	12.5 kw/wing	30 kw/wing	60 kw/wing
	Heavy Blanket Unbroken	Light Blanket Unbroken	Light Blanket Broken
Weight, W_{SS}	2.66 lb (1.21 kg)	1.45 lb (0.66 kg)	2.18 lb (0.99 kg)

The function of these struts is to support the container/blanket assembly during launch, see Figure D12. It will be assumed that the weight is determined by the blanket weight for either stress or buckling limited designs.

$$W_{SS} = C_8\, \ell_B\, w_B\, \gamma_A + C_9 \tag{D51}$$

The three data points above do not fit Equation (D51) too well. A least squares fit with a bias toward the 12.5 kw/wing configuration gives the following relationship.

$$W_{SS} = 0.0037\, \ell_B\, w_B\, \gamma_A + 1.73 \tag{D52}$$

The weights for the 30 kw/wing and 60 kw/wing configuration with heavy solar cells can be estimated as

$$W_{SS} = 3.18 \text{ lb } (1.63 \text{ kg}) \qquad \text{for 30 kw/wing}$$

and

$$W_{SS} = 5.46 \text{ lb } (2.48 \text{ kg}) \qquad \text{for 60 kw/wing}$$

5. Box Hinge Structure (Broken Configuration Only)

LMSC does not provide enough detail in Reference 13 for the design of the box hinge structure for the broken configuration, nor are weights listed for these items.

An arbitrary criteria for sizing the structure was selected. It seemed desirable to have the hinge structure stiff enough such that it contributes the same deflection to the system as the container.

Figure D13 shows a schematic of the box hinge structure design. The stiffness of the container has been estimated using one inch thick honeycomb with a fiberglass face sheet thickness t.

The relationship for the container stiffness and its weight is approximated by

$$EI \approx 10.26 \frac{W_{CC}}{w_B} \tag{D53}$$

Equating the tip rotation of a 40 inch segment of the container to that resulting from the hinge structure for an articulating container segment of length ℓ_e the strut weight can be related to the box cover weight for each side by

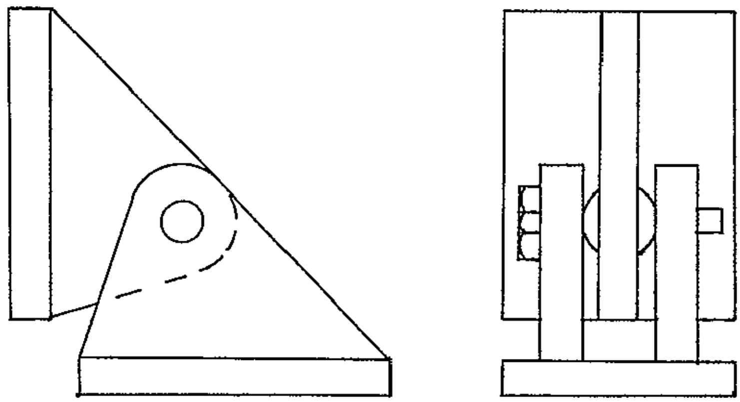


Figure D13. Box Hinge Structure Concept

$$W_{BH} = 0.1793 \times 10^{-3} \frac{W_{CC} \ \ell_e^2}{w_B} \tag{D54}$$

Substituting into the above the expression for the container weight, multiplying by two to account for two such structures and adding 20% for fittings, the following expression for the box hinge structure is obtained.

$$W_{BH} = 0.36 \times 10^{-4} \ \ell_e^2 \ \ell_B \ \gamma_A + 0.31 \times 10^{-4} \ \ell_e^2 \tag{D55}$$

The box hinge structure weight for the broken 60 kw/wing array with ℓ_e = 157 in., ℓ_B = 2000 in., γ_A = 0.00128 lb/in.^{2} is estimated as

$$W_{BH} = 3.0 \text{ lb } (1.4 \text{ kg})$$

ROLLOUT ARRAY

The rollout array weights are defined for two different configurations, a nominal 10 kw/wing array and a 60 kw/wing array. The details for the 10 kw/wing array configuration are contained in Reference 14. The 60 kw/wing configuration is defined in Reference 15. Both configurations use 3 mil (75 micron) solar cells with a 1 mil (25 micron) cover sheet, and a 1.5 mil (38 micron) substrate. The nominal power density is 0.000090 kw/in.^{2} (0.139 kw/m^2) and a corresponding weight density of 0.000523 lb/in.^{2} (0.368 kg/in.^{2}).

NOMENCLATURE

A	Cross Sectional area, $in.^2$
c	Distance from Neutral Axis for Bending Beam, in.
C_i	Constant
d_D	Drum Diameter, in.
d_S	Shaft Diameter, in.
F_D	Drum Tension Load, lb
F_R	Drum Reaction Load, lb
I	Section Moment of Inertia, $in.^4$
ℓ_B	Blanket Length, in.
ℓ_{CC}	Distance from Array Centerline to Drum Edge, in.
ℓ_D	Drum Length, in.
ℓ_H	Header Length, in.
ℓ_S	Shaft Length, in.
M	Moment, in.-lb
w_B	Blanket Width, in.
W_B	Blanket Weight, lb
W_{CS}	Center Support Weight, lb
W_D	Drum Weight, lb
W_{FB}	Folding Structure Weight at Base, lb
W_{FH}	Folding Structure Weight at Header, lb
W_H	Header Weight, lb
W_{LE}	Leading Edge Member Weight, lb
W_S	Shaft Weight, lb
γ_A	Blanket Area Density, $lb/in.^2$
θ	Beam Rotation, Radians

DERIVATION OF SCALING EQUATIONS

1. Drum

A sketch of the drum is shown in Figure D14.

The following data are available for extrapolation from the two conceptual design configurations:

	10 kw/wing	60 kw/wing
Drum Weight, W_D, lb each, 2 required/wing	6.5	11.5
Blanket Weight, W_B, lb	30.8	158.1
Drum Tension Load, F_D, lb	1.6	27.6
Drum Length, ℓ_D, in.	87	150
Drum Diameter, d_D, in.	12	12

An observation is made immediately that the drum weight is nearly proportional to the drum length with a lineal weight of 0.075 lb/in. for the 10 kw/wing configuration and 0.77 lb/in. for the 60 kw/wing configuration. This would indicate that the design is not stress limited as for a stress limited case the drum weight would be proportional to the drum length squared and the mass loading (drum mass plus blanket mass).

It will be assumed that the drum weight can be expressed in the following form:

$$W_D = C_{10} W_B + C_{11} \ell_D \tag{D56}$$

solving the above for C_{10} and C_{11} for the two cases W_D = 6.5 lb, W_B = 30.8 lb, ℓ_D = 87 in. for the 10 kw/wing configuration and W_D = 11.5 lb, W_B = 158.1 lb, ℓ_D = 150 in. for the 60 kw/wing configuration

$$C_{10} = 0.0028 \qquad C_{11} = 0.0737$$

Thus

$$W_D = 0.0028\ \ell_B\ w_B\ \gamma_A + 0.0737\ \ell_D \tag{D56a}$$

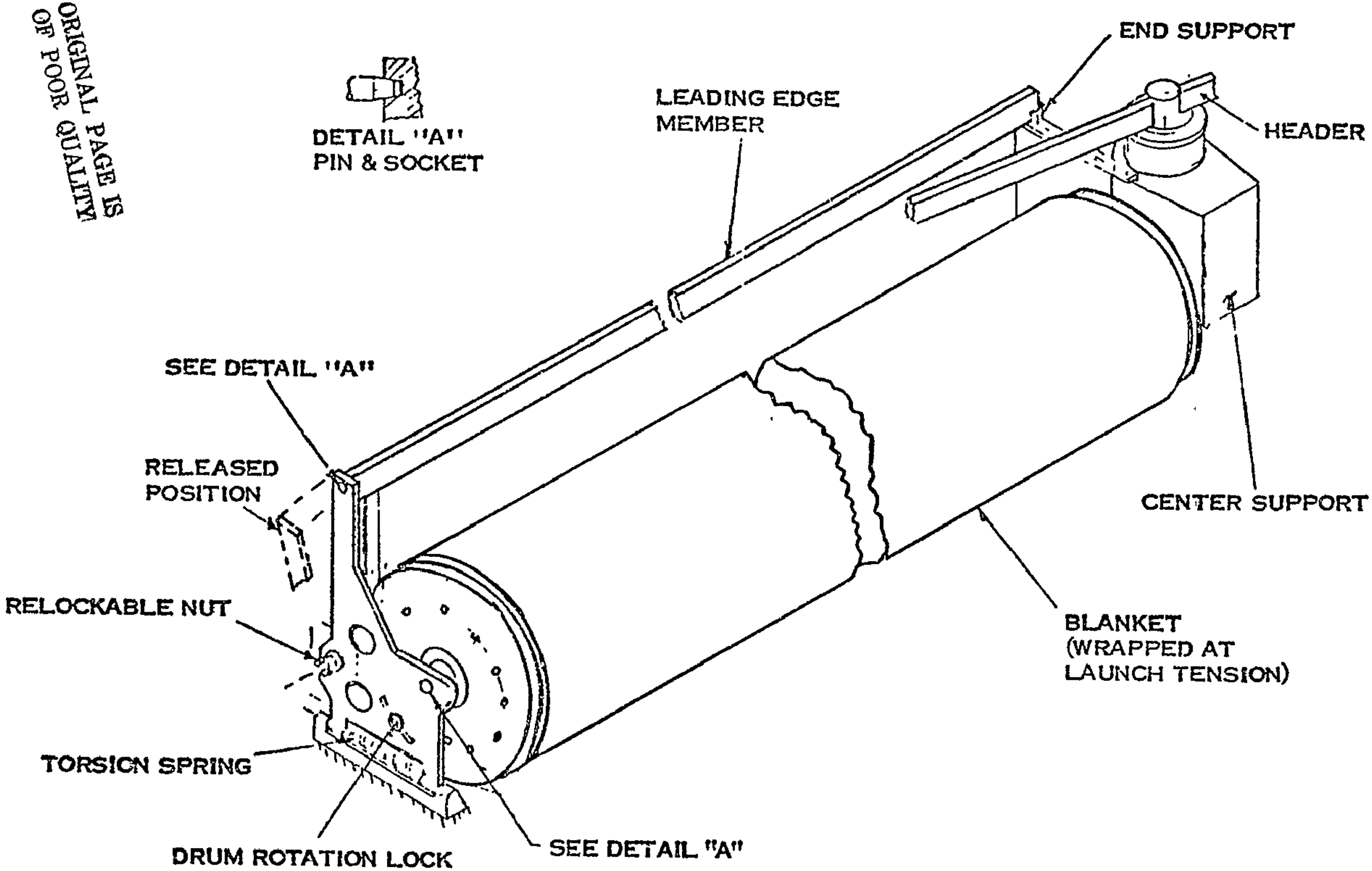


Figure D14. Structural Elements for Rollout Design

2. Shaft

The following data for two conceptual designs were used for deriving the weight scaling equation. A sketch of the shaft is shown in Figure D15.

	10 kw/wing	60 kw/wing
Shaft Weight, W_S, lb each, 2 required/wing	0.48	7.08
Drum Length, ℓ_D, in.	87	150
Blanket Tension Load, F_D, lb	1.6	27.6
Distance from Array Centerline to Drum Edge, ℓ_{CC}, in.	6.3	15.7
Blanket Length, ℓ_B, in.	677	2382

In deriving the weight scaling equation for the shaft the following conditions will be considered: (a) shaft bending due to blanket tension, limitations due to stress or deflection, (b) launch loads due to drum weight, stress limitation:

(a) Shaft Bending

The moment acting on the shaft is

$$M = \frac{1}{2} F_D \ell_D \quad .$$

Assume the shaft diameter to be

$$d_S \approx \frac{d_D}{2}$$

(i) Stress Limitation

$$\sigma = \frac{M_c}{I} \qquad C \approx \frac{d_D}{4}$$

$$I \approx \frac{\pi d_D^3 t}{64} \qquad A = \frac{\pi d_D t}{2}$$

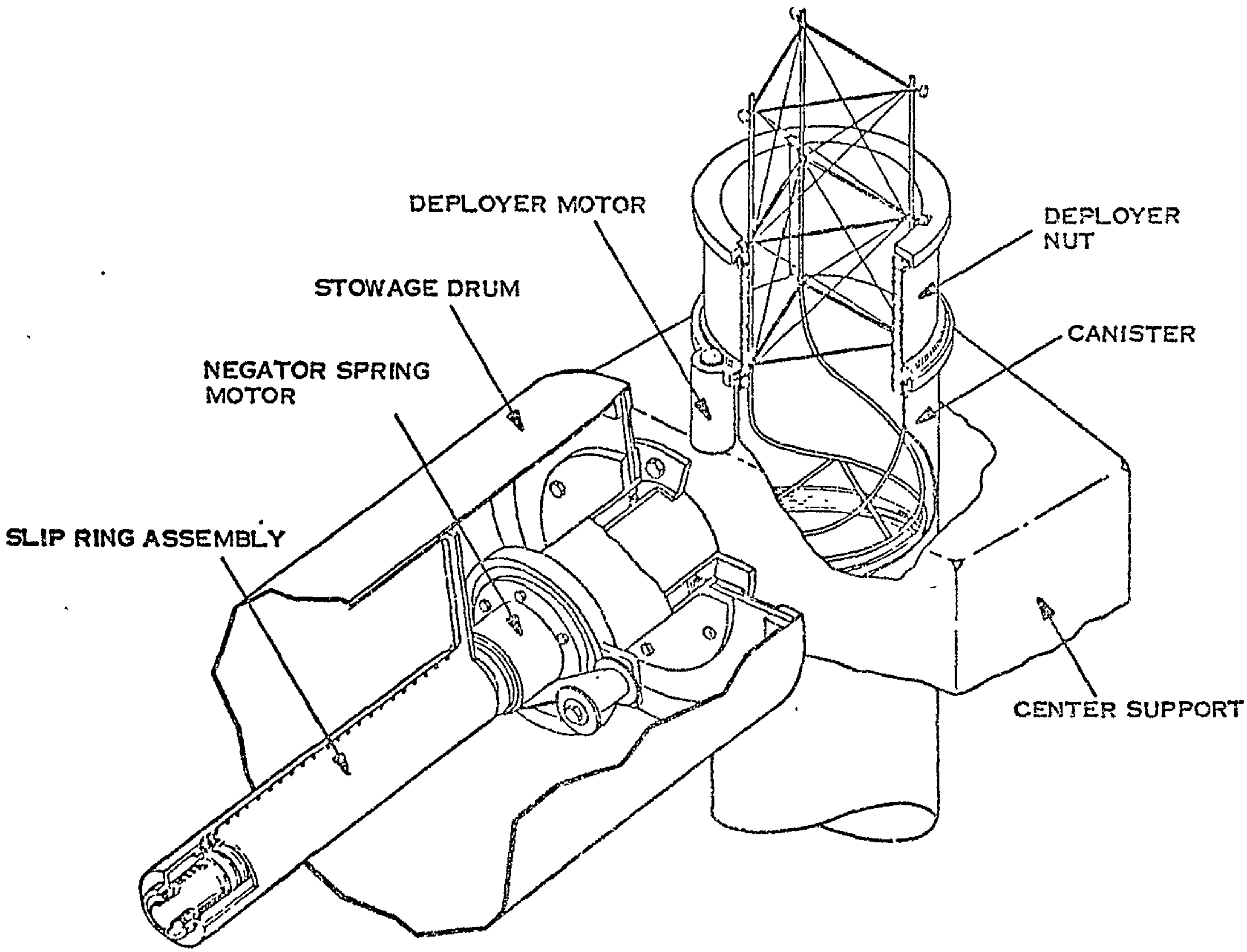


Figure D15. Cut-Away View of Boom and Storage Drum for Rollout Design

Assume that the shaft length ℓ_S is the same as the distance between the centerline and the drum edge

$$\ell_S \approx \ell_{CC}$$

and furthermore

$$\ell_{CC} \approx 0.1\ \ell_D$$

The shaft weight, W_S, can then be written as

$$W_S = A\ \ell_C\ \rho$$

$$W_S = 0.05\ \pi d_D t\ \ell_D\ \rho$$

$$\sigma = \frac{8F_D\ \ell_D}{\pi d_D^2 t}$$

and

$$W_S = \frac{0.4\ \ell_D^2\ \rho\ F_D}{\sigma d_D} \tag{D57}$$

Since d_D, σ and ρ will be assumed constant for stress scaling, assume the form of the scaling equation to be

$$W_S = C_{12}\ \ell_D^2\ F_D + C_{13} \tag{D58}$$

where the constant C_{13} is to account for fitting weights. Solving Equation (D58) for C_{12} and C_{13} by using the 10 kw/wing and 60 kw/wing data

$$C_{12} = 1.084 \times 10^{-5} \qquad C_{13} = 0.35$$

Thus

$$W_S = 1.084 \times 10^{-5}\ \ell_D^2\ F_D + 0.35 \qquad \text{(D58a)}$$

(ii) Deflection Limitation

The rotation due to a moment

$$\theta = \frac{M\ell}{EI}$$

$$\theta = \frac{3.2\ F_D\ \ell_D^2}{E\ \pi d_D^3\ t}$$

then the shaft weight W_S can be related to the deflection

$$W_S = \frac{0.16\ F_D\ \ell_D^3\ \rho}{E\ d_D^2\ \theta} \qquad \text{(D59)}$$

Assume the shaft material is aluminum

$$E = 10 \times 10^6\ \text{lb/in.}^2 \qquad \rho = 0.1\ \text{lb/in.}^3$$

Then

$$W_S = 1.11 \times 10^{-11}\ \frac{F_B\ \ell_D^3}{\theta} \qquad \text{(D59a)}$$

the form of the scaling equation then becomes

$$W_S = C_{14}\ F_D\ \ell_D^3 + C_{15} \qquad \text{(D60)}$$

From which, using the available data

$$C_{14} = 7.166 \times 10^{-8} \qquad C_{15} = 0.41$$

and

$$W_S = 7.166 \times 10^{-8}\ F_D\ \ell_D^3 + 0.41 \tag{D60a}$$

(b) Shaft Loading during Launch

To obtain the reaction of the drum on the shaft it will be assumed that the drum is excited in its first bending mode, a magnification factor of Q = 50 and an effective mass of 61% of the total mass.

Then the force acting on the shaft is

$$F_R = \frac{1}{2}\ (50)\ (0.61)\ (W_D + W_B) \tag{D61}$$

using Equation (D56a)

$$F_R = 12.25\ (1.003\ell_B\ell_D\gamma_A + 0.0737\ell_D) \tag{D61a}$$

and the moment on the shaft assuming a shaft length of $\ell_S \approx 0.1\ \ell_D$

$$M = 1.53\ \ell_B\ell_D^2\ \gamma_A + 0.112\ \ell_D^2 \tag{D62}$$

For this condition it will be assumed that the shaft is stress limited.

Then the shaft weight can be related to the stress by the equations shown under (a)(i) above.

$$W_S = C_{16}\ (0.0102\ell_B\gamma_A + 0.00075)\ \ell_D^3 + C_{17} \tag{D63}$$

Solving for C_{16} and C_{17} by using the 10 kw/wing and 60 kw/wing data.

$C_{16} = 0.000167$ $\qquad C_{17}\ 0.032$

$$W_S = (1.706 \times 10^{-6}\ \ell_B\gamma_A + 1.25 \times 10^{-7})\ \ell_D^3 + 0.03 \tag{D63a}$$

Comparing Equation (D63a) to Equation (D58a) it is concluded that the effective stress in the shaft due to the blanket tension is lower than due to the launch condition. Thus for the shaft weight the larger of the weight obtained from the following two equations will be used.

$$W_S = 7.166 \times 10^{-8} F_D \ell_D^3 + 0.41 \qquad \text{(D60a)}$$

$$W_S = (1.706 \times 10^{-6} \ell_B \gamma_A + 1.25 \times 10^{-7}) \ell_D^3 + 0.03 \qquad \text{(D63a)}$$

3. Center Support

The function of the center support is similar to that of the shaft, see Figures D14 and D15. The procedure for the derivation of the weight equation for the center support is identical to that used for the shaft.

	10 kw/wing	60 kw/wing
Center support weight, W_{CS}, lb each, 1 required per wing	4.91	19.62
Drum Length, ℓ_D, in.	87	150
Blanket Tension Load, F_D, lb	1.6	27.6

(a) Bending in Deployed Configuration

Consider only deflection limited condition. The weight equation is of the form

$$W_{CS} = C_{18} F_D \ell_D^3 + C_{19} \qquad \text{(D64)}$$

using the data available for the 10 kw/wing and 60 kw/wing configurations

$$C_{18} = 1.596 \times 10^{-7} \qquad C_{19} = 4.75$$

$$W_{CS} = 1.596 \times 10^{-7} F_D \ell_D^3 + 4.75 \qquad \text{(D64a)}$$

C-4

(b) Loading During Launch

The stress limited condition indicates a weight equation of the form

$$W_{CS} = C_{20} \; (0.01020 \; \ell_B \gamma_A + 0.00075) \; \ell_D^3 + C_{21} \tag{D65}$$

using the available data

$$C_{20} = 0.000372 \qquad C_{21} = 3.91$$

$$W_{CS} = (3.80 \times 10^{-6} \; \ell_B \gamma_A + 2.79 \times 10^{-7}) \; \ell_D^3 + 3.91 \tag{D65a}$$

The center section weight will be evaluated using Equations (D64a) and (D65a) and the larger of the two values will be used.

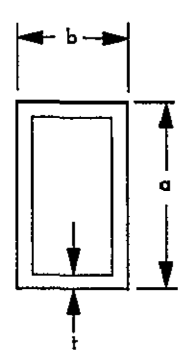
4. Header

The header is affected only by the deployed loading of the blanket tension, see Figure D14. Both a stress limitation and a deflection limitation will be used to derive the scaling equations. The following data are available for the baseline configuration.

	10 kw/wing	60 kw/wing
Header Weight, W_H, lb, one required/wing	1.98	4.36
Drum Length, ℓ_D, in.	87	150
Blanket Tension Load, F_D, lb	1.6	27.6

(a) Stress Limitation

Assume a cross-section as follows:



$t << b$

$a/b = 2$

$b \approx 0.1 \; d_D$

then

$$A = 0.6\ t\ d_D$$

$$I = 0.00333\ t\ d_D^3$$

The header length will be assumed

$$\ell_H \approx 1.2\ \ell_D$$

The header weight then is

$$W_H = A\ell_H\rho \qquad \rho = 0.056\ \text{lb/in.}^3 \text{ for graphite epoxy}$$

$$W_H = 0.0403\ t\ d_D\ell_D$$

The moment is

$$M = 0.6\ F_B\ell_D$$

$$\sigma = \frac{Mc}{I} \qquad c = \frac{a}{2} = b - 0.1\ d_D$$

Relating W_H to σ

$$W_H = 0.726\ \frac{F_D\ell_D^2}{\sigma d_D} \tag{D66}$$

Then the weight scaling equation will be assumed of the form

$$W_H = C_{22}\ F_D\ell_D^2 + C_{23} \tag{D67}$$

Solving for C_{22} and C_{23} from the available data

$$C_{22} = 3.91 \times 10^{-6} \quad \text{and} \quad C_{23} = 1.93$$

Thus

$$W_H = 3.91 \times 10^{-6}\ F_B \ell_D^2 + 1.93 \tag{D67a}$$

(b) Deflection Limitation

The tip rotation can be expressed as

$$\theta = \frac{M\ell}{EI}$$

$$\theta = \frac{108.11\ F_D \ell_D^2}{E\ d_D^3\ t}$$

Then

$$W_H = \frac{2.179\ F_D \ell_B^3}{E\ d_D^2\ \theta} \tag{D68}$$

Assuming E, d_D and θ to be constant the scaling equation is of the form

$$W_H = C_{24}\ \ F_D \ell_D^3 + C_{25} \tag{D69}$$

with

$$C_{24} = 2.584 \times 10^{-8} \qquad C_{25} = 1.95$$

$$W_H = 2.584 \times 10^{-8}\ F_D \ell_D^3 + 1.95 \tag{D69a}$$

For the header the weight will be determined from Equations (D67a) and (D69a) and the larger of the two will be chosen.

5. Leading Edge Member

The leading edge member, according to GE, consists of a rectangular cross-sectional beam with minimum gauge (0.030 in.) thickness wall, constant weight per length. See Figure D14 for sketch of Leading Edge Member.

	10 kw/wing	60 kw/wing
Leading Edge Member weight, W_{LE}, lb	1.06	2.16
Drum Length, ℓ_D, in.	87	150

For constant weight/length

$$W_{LE} = C_{26} \ell_D \tag{D70}$$

$$C_{26} \approx 0.0133$$

$$W_{LE} = 0.0133 \ell_D \tag{D70a}$$

6. Folding Structure for Broken Arrays

To obtain an estimate for the weight of the folding structure for the broken arrays it was assumed that the major function of the structure is to provide support during the launch phase. Since the structure is not well defined it has been arbitrarily assumed that the folding structure weight located at the array base is 15% of the center support weight and similarly the folding structure of the header weighs 15% of the header weight, as determined from the launch constraint.

Thus for the base

$$W_{FB} = (5.7 \times 10^{-7} \ell_B \gamma_A + 4.18 \times 10^{-8}) \ell_D^3 + 0.59 \tag{D71}$$

and for the header assuming a stress limited design

$$W_{FH} = 5.86 \times 10^{-7} F_B \ell_D^2 + 0.29 \tag{D72}$$

APPENDIX D

SECTION I

PART 4

SCALING EQUATIONS FOR
THE WEIGHTS OF THE
MECHANISMS

APPENDIX D

SECTION I — PART 4

SCALING EQUATIONS FOR THE WEIGHTS OF THE MECHANISMS

APPROACH

The scaling equations for the mechanisms have been derived using the weight data supplied for the conceptual designs. The weight data for the foldout array was obtained from references 12 and 13. The rollout array weights are contained in references 14 and 15.

In developing the scaling equations, it was assumed that each mechanisms scales linearly, nonlinearly or does not change significantly in weight.

The assumptions made in arriving at the scaling equation for each mechanism are described as part of the derivation.

FOLDOUT ARRAY

Nomenclature

- A - Intermediate tension distribution bar attachment point-assumed to be $0.9L_1$
- B - Blanket preload, psi
- L - Mast length
- L_1 - Blanket length, ft
- N - Negator spring weight, lb
- N_H - Negator hub weight, lb
- N_R - Negator reel weight, lb
- P - Wing power, kW
- P_W - Panel wire retainer weight, lb
- S - Shaft weight, lb
- T - Total blanket tension, lb
- T_1 - Full blanket tension, lb

T_2 - Intermediate blanket tension, lb

T_3 - Guide wire tension, lb

TM_1 - Full tensioning mechanism weight, lb

TM_2 - Intermediate tensioning mechanism weight, lb

TM_3 - Guide tensioning mechanism weight, lb

Tq - Containment box deployment torque required (in.-lb)

W - Tensioner wire weight, lb

W_B - Blanket width, in.

W_R - Wire reel weight, lb

W_S - Washer weight, lb

DERIVATION OF SCALING EQUATIONS

1. Tensioning Mechanisms

The tensioning mechanisms consist of the following parts: Wire, negator spring, wire reel, negator hub, negator reel, shaft and washers. The guide wire tensioner also includes panel wire retainers.

The wire, negator spring and the panel wire retainers are assumed to scale linearly and 1:1 with blanket length. The wire reel and spring reel are assumed to scale linearly but less than 1:1 with blanket length. The negator spring is assumed to scale linearly and 1:1 with mechanism tension. The spring hub is assumed to scale linearly but at a rate of less than 1:1 with mechanism tension. The shaft and washer remain constant.

Using the above assumptions, the guide wire tensioner weight can be written as follows:

$$TM_3 = \frac{L}{102}\left(W + N\frac{T_3}{1} + P_W\right) + \left(\frac{L}{102} - 1\right)\left(1.5W_R + 0.1N_R\right) + \left(\frac{T_3}{1} - 1\right) 2N_H + S + W_S + W_R + S_H + S_R \tag{D73}$$

Using the weight information supplied in reference 12, the variables in equation (D73) can be filled in,

$$TM_3 = \frac{L}{102}\left(0.001 + 0.455\,\frac{Ts}{1} + 0.006\right) + \left(\frac{L}{102} - 1\right)\Big[0.15\ (0.111)$$

$$+\ 0.1\ (0.053)\Big] + \left(\frac{T_3}{1} - 1\right) 0.2\ (0.086) + 0.111 + 0.066 \qquad \text{(D73a)}$$

$$+\ 0.153 + 0.026 + 0.007$$

If equation (D73a) is simplified and converted to lbs, the result is

$$TM_3 = 0.022L\left(0.007 + 0.455\ T_3\right) + \left(\frac{L}{102} - 1\right) 0.048$$

$$+\left(T_S - 1\right) 0.029 + 0.579 \qquad \text{(D73b)}$$

It should be noted that two of each tensioning mechanism are required for each wing.

Using the same steps as above, the equations for the intermediate and full tensioning mechanism can be written as:

$$TM_2 = 0.024\ A\left(0.001 + 0.755\ T_2\right) + (0.01A - 1)\ 0.11 + 0.807 \qquad \text{(D74)}$$

$$TM_1 = \left(L - L_1\right) T_1\ 0.036 + \left(L - L_1 - 1\right) 0.037 + 0.00234\ T_1$$

$$+\ 0.407 \qquad \text{(D75)}$$

In the MSFC/LMSC array the mast length is approximately 1 meter longer than the blanket length and this number should be used as the minimum difference between the two.

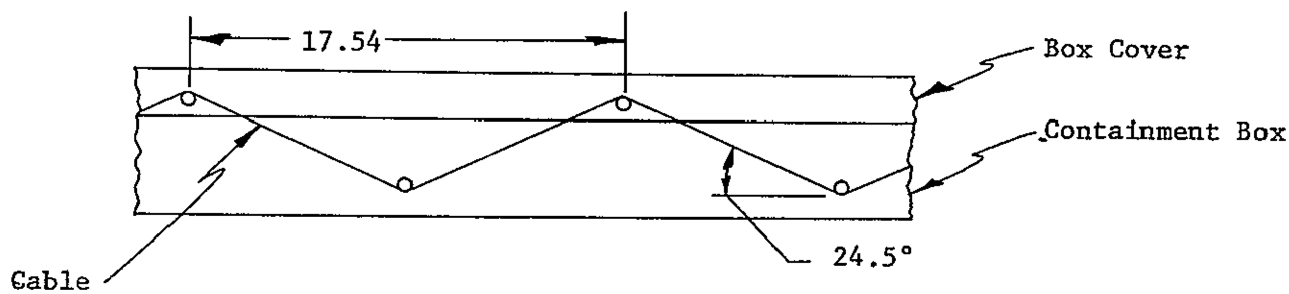
2. Tension Transfer Mechanism Weight

The tension transfer mechanism weight scales directly with blanket width. Using weight information from reference 12, the scaling equation can be written as:

$$\text{Tension transfer weight} = 1.14 \times 10^{-4}\ W_B \tag{D76}$$

3. Containment Box Cover Launch Latch Weight

It is assumed that the folded width of a MSFC/LMSC blanket will remain at its present 14.85 in. while the array power output increases, and the containment box width is constant at 17.54 in., then the latch configuration will be as shown below:



The force that must be reacted by each latch pin can be found from

$$\text{Latch force} = 17.54 \times \frac{14.85}{2} \times B \tag{D77}$$

If the 1.5 psi preload for the 12.5 kW array is used the latch force is

$$17.54 \times \frac{14.85}{2} \times 1.5 = 195 \text{ lbs.} \tag{D78}$$

The tension in the cable is

$$\frac{195}{2 \sin 24.5} = 235.5 \text{ lb.} \tag{D79}$$

A 1/16 in. Mil - C - 1835 cable with a breaking strength of 360 lb. can be used to provide a safety factor of 1.5. The cable weight per in. is 6.25×10^{-4} lb and scales directly with blanket preload. The length of the cable between latch points is

$$2\sqrt{\left(\frac{17.54}{2}\right)^2 + 4^2} = 19 \text{ in.} \tag{D80}$$

and there are

$$\frac{W_g}{17.54} \quad \text{Latch points per side} \tag{D81}$$

The cable weight can then be written as:

$$\text{Cable weight} = \frac{B}{1.5}\, 6.25 \times 10^{-4}\ (19) \left(\frac{2W_B}{17.54}\right) + 2(17.54)\ \ 6.25 \times 10^{-4} \tag{D82}$$

The hardware needed for each latch point, (a latch pin on the cover, a latch pin on the box, and a spring on the cover latch pin) weighs 0.015 lb. The expression for the latch point hardware is

$$0.015 \left(\frac{2W_B}{17.54}\right) \tag{D83}$$

The hardware with a constant weight are pin pullers (0.385 lb), squibs (0.132 lb) and cable ends (0.223 lb) which weigh a total of 0.74 lb.

The scaling equation for the total cover latch weight is

$$\text{Latch weight} = \frac{B}{1.5}\, 6.25 \times 10^{-4}\ (19)\ \frac{2W_B}{17.54} + 2(17.54)\ 6.24 \times 10^{-4} + 0.015 \left(\frac{2W_B}{17.54}\right) + 0.74 \tag{D84}$$

or

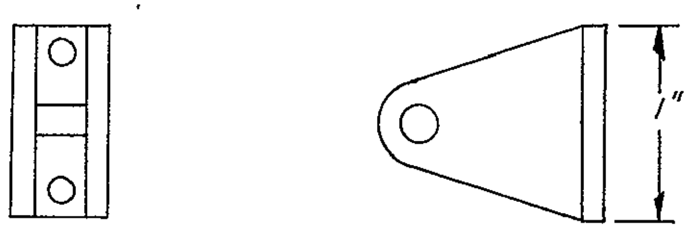
$$\text{Latch weight} = 9.03 \times 10^{-4}\ BW_B + 1.71 \times 10^{-3}\ W_B + 0.762 \qquad \text{(D84a)}$$

For the unbroken MSFC/LMSC array equation (D84a) is used once; however, for a broken array the equation is used three times, once for each containment box.

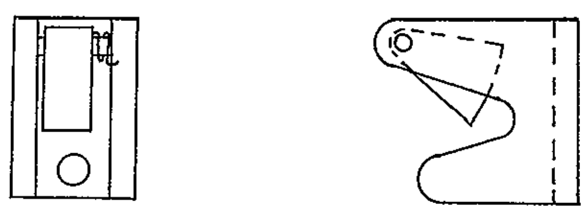
4. Containment Box Launch Latches

For purposes of estimating weight the following latch was conceived:

CATCH



LOCK



Both the lock and the catch are of aluminum construction except for the pins and lock spring which are stainless steel. The weight of the latch is 0.022 lb for the catch and 0.03 lb for the lock.

Assuming that the latch would fail through bearing of the 3600 psi yield lock dog on the catch pin the maximum latching force is:

$$0.25\ (\text{projected pin area})(\text{Cos } 36°)(32000) = 303 \text{ lbs} \qquad \text{(D85)}$$

Since the load capacity of the latch can be increased (by changing the pin diameter) with a small increase in latch weight it was assumed that the latch masses will remain constant.

In cases where part of the latch was connected to the solar array and part was connected to the spacecraft, only the weight of the part of the latch connected to the solar array was included.

A pin puller will be attached to the spacecraft and a catch will be attached to each end of the folded containment box. The weight of the latch which is charged against the solar array is constant at 0.06 lb per wing.

5. Containment Box Cover Cruise Latch

The containment box cover cruise latch mass is also the same as the latch described in part 4 above. Six latches are required for a total of 0.312 lb.

6. Containment Box Cruise Latch

The containment box cruise latch will be a folding strut like the Voyager RTG boom folding strut. The Voyager weight of 1.23 lb will be used. Two folding struts are required for a total of 2.46 lb.

7. Containment Box Deployment Actuator

The baseline containment box deployment actuator is the actuator used for the Voyager RTG boom deployment except that the number of springs have been doubled. Since there is little known about the deployment torque needed, the scaling equation is written as a function of deployment torque required and another relation is supplied as a guide for determining required torque.

$$\text{Containment box deployment actuator weight} = 0.909 \frac{Tq}{108} \qquad \text{(D86)}$$

where

$$Tq = 10P \qquad \text{(D87)}$$

The relation for deployment torque required, Tq, should only be used in the absence of more accurate torque data. Two deployment actuators are required per wing.

8. Summary

The scaling equations for the MSFC/LMSC solar array are as follows:

- Guide wire tensioning mechanism - two required per wing.

$$TM_3 = 0.022L \left(0.007 + 0.455\ T_3\right) + \left(\frac{L}{102} - 1\right) 0.048 + \left(T_3 - 1\right) 0.029 + 0.579 \qquad \text{(D73b)}$$

- Intermediate tensioning mechanism - two required per wing.

$$TM_2 = 0.024\ A \left(0.001 + 0.755\ T_2\right) + (0.01A - 1)\ 0.11 + 0.807\ , \qquad \text{(D74)}$$

- Full tensioning mechanism - two required per wing

$$TM_1 = 0.036\ T_1 \left(L - L_1\right) + 0.037 \left(L - L_1\right) + 0.00234\ T_1 + 0.407 \qquad \text{(D75)}$$

- Tension transfer

Tension transfer weight = $1.14 \times 10^{-4}\ W_B$

- Containment box cover launch latch weight

latch weight = $9.03 \times 10^{-4}\ BW_B + 1.71 \times 10^{-3}\ W_B + 0.762$ unbroken array

latch weight = $9.03 \times 10^{-4}\ BW_B + 1.71 \times 10^{-3}\ W_B + 0.762$ (D84a)

$+ 2\left(9.03 \times 10^{-4}\ BW_{B1} + 1.71 \times 10^{-3}\ W_{B1} + 0.762\right)$ broken array; where W_{B1} is the width of the end blankets, in.

- Containment box launch latches

0.06 lb constant

- Containment box cruise latches - broken array only

2.46 lb constant

- Containment box cover cruise latches - broken array only

0.312 lb constant

- Containment box deployment actuator - two required, broken array only

$$0.909 \frac{Tq}{108} \text{ where } Tq = 10P \qquad \text{(D86), (D87)}$$

ROLLOUT ARRAY

Nomenclature

- b - Spring width, in.
- D - Mast diameter, in.
- D_3 - Spring hub diameter, in.
- L - Mast length, ft
- L_p - Number of drum launch latch points required per wing
- Ls - Negator spring length, in.
- M - Individual spring torque required, in.-lb
- Mt - Drum torque required per blanket, in.-lb
- n - Number of springs used in each drum
- N - Number of turns of the drum for deployment
- P - Array power, kW
- R - Drum radius, in.
- t - Spring thickness, in.
- T - Total blanket tension, lb
- Tp - Blanket tension required for partial deployment, lb
- Wb - Weight of drum bearings, lb
- Wc - Sleeve weight, lb
- Ws - Spring weight, lb

DERIVATION OF SCALING EQUATIONS

1. Tensioner

The tensioner has the two-fold function of holding the blanket flat by

pulling it tight during deployment, and restowing the blanket by rolling it onto the drum when the mast is retracted.

The tensioner performs these functions by having a negator spring wound around drum shaft which provides a torque to the drum which pulls the blanket tight.

Reference 14 gives the total tensioner weight for the 10.5 kW rollout wing as 1.32 lb (0.60 kg) with two being required per wing. Since no weight breakdown is given for the tensioner in reference 14, tensioner weight breakdown from reference 12 was used to obtain all tensioner motor component weights except the spring weight. The spring weight can be obtained as follows:

The torque (M) which the tensioner is required to impart to the drum can be found from

$$M = RT \tag{D88}$$

Once obtained, M is used to enter chart W in reference 21 where t, D_3 and b are obtained. The required weight of the spring can be calculated from

$$Ws = \left[\pi N\left(D_3 + Nt\right) + 10D_3\right]n\ 0.29bt \tag{D89}$$

where

$$N = \frac{6L}{\pi R} \tag{D90}$$

and 0.29 is the weight density of the spring.

From reference 12, the weight of the tensioner components other than the spring are found to be 0.449 lb. The tensioner weight then becomes:

$$\left[\pi N\left(D_3 + Nt\right) + 10D_3\right]n\ 0.29bt + 0.449,\ \text{lb} \tag{D91}$$

Equation (D90) yields a weight of 1.199 lb (0.546 kg) per blanket or 2.398 lb (1.09 kg) per wing for the 10.5 kW rollout array.

If the tensioner weight for the 60 kW/wing rollout array is calculated as above, the result is 127.616 (58 kg)/wing rather than the 51.7416 (23.52 kg) published in reference 15.

If it is assumed that the blanket tension required at any partial deployment position is expressed by:

$$T_p = T^{Lp} \tag{D92}$$

where

$$Lp = \frac{\text{partially deployed length}}{\text{fully deployed length}} \tag{D93}$$

and it is also assumed that four springs are used to tension each blanket, then the torque required from each spring at any partial deployment position can be written as

$$M = \frac{M_t^{Lp}}{n} \tag{D88a}$$

If it is assumed that the tension is to change in a step function at 25%, 50% and 75% of deployment and remain constant between these deployment lengths, then equation (D89) can be rewritten as

$$Ws = 4\left[\pi\frac{N}{4}\left(D_3 + \frac{N}{4}t\right) + 10D_3\right] bt\ 0.29 \tag{D89a}$$

M must be calculated four times, using Lp = 0.25, 0.5, 0.75 and 1, and used to find values for D_3, b and t, from chart W in reference 21. Equation (D89a) must then be used four times to calculate Ws_1, Ws_2, Ws_3 and Ws_4. The weight of the tensioner may then be found from

$$\text{tensioner weight} = \left(Ws_1 + tWs_2 + tWs_3 + tWs_4 + 0.288\right) \tag{D94}$$

Using the above method to calculate the tensioner weight for the 60 kW/wing roll-out array 52.03 lb (23.6 kg) is obtained which compares favorably with the 51.74 lb (23.52 kg) given in reference 15.

2. Slip Ring Assembly

Reference 14 gives the weight of the slip ring assembly for the 10.5 kW/wing rollout array as 2.86 kg (6.30 lb), and reference 15 gives the weight of the slip ring assembly for the 60 kW/wing rollout array as 4.52 kg (9.96 lb).

Since no other information was available, the scaling equation of the slip ring assembly was obtained by drawing a line between the two data points and finding the equation of the line:

$$\text{Slip Ring Assembly Weight (lb)} = 0.0739P + 5.51 \tag{D95}$$

3. Drum Bearing Weight

As with the slip ring assembly, very limited information was available about the drum bearings. The drum bearing weight was scaled in a straight line fashion as a function of total tension of both blankets. The equation is:

$$W_b = T\ 0.0127 + 1.28 \tag{D96}$$

4. Mast Sleeve

The weight of the teflon was calculated as follows:

The sleeve diameter (D') is assumed to be 4 in. larger in diameter than the mast. The 1/2 mil. silverized teflon weighs 6.17×10^{-3} lb/ft^2. To clamp the sleeve two aluminum rings D' in diameter 0.062 in. thick and 1 in. wide will be used.

The scaling equation can then be written as:

$$Wc = \frac{\pi D'L\ 6.17 \times 10^{-3}}{12} + \frac{2\pi D'\ 0.1}{16} \tag{D97}$$

$$Wc = \pi D'\ (5.14 \times 10^{-4}L + 0.0125),\ \text{lb.} \tag{D95a}$$

5. Latches

The latches to be used for the rollout array are the same as described in part 4 under the foldout array. In cases where part of the latch was connected to the solar array and part to the spacecraft, only the solar array weight is included.

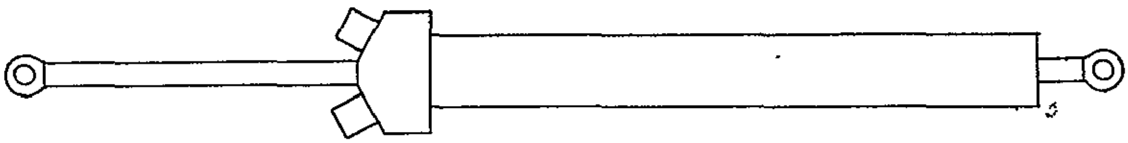
The drum launch latch consists of a pin puller mounted on the spacecraft and a catch (with holes drilled in it rather than having a catch pin) mounted on the drum. Assuming that only one latch is needed per drum, the weight to be charged to the solar array is 0.044 lb.

Each drum cruise latch consists of one lock and one catch. The total weight of drum cruise latches is 0.104 lb.

Each header also requires one lock and one catch for a total of 0.104 lb. The total latch mass then is 0.252 lb.

6. Drum Deployment Actuator

Since General Electric made no provision for folding the drum during launch, they had no drum deployment actuator. The following design was conceived for the purposes of this study.



The extended length is approximately 16 in. while the contracted length is approximately 8 in.

Since little is known about the torque required to deploy the drum, the actuator will be designed to provide up to 1000 in.-lb deployment torque. With the actuator acting along a line 3 in. from the center of the joint, 333 lb force are required. With a 0.125 in. diameter plunger the plunger stress will be

$$\frac{333\text{ lb}}{\left(\frac{0.125}{2}\right)^2 \pi} = 27{,}000\text{ psi}$$

which can be easily obtained with aluminum. If a 0.5 in. ID tube is used for the actuator, the area is

$$\pi\left(0.25^2 - 0.062^2\right) = 0.184\text{ in.}^2 \tag{D98}$$

and the required pressure is

$$\frac{333 \text{ lb}}{0.184 \text{ in.}^2} = 1809 \text{ psi} \tag{D99}$$

Assuming that 100,000 psi yield stainless steel will be used for the cylinder the wall thickness must be

$$\frac{0.5 \text{ in.} \times 1809 \text{ psi}}{2 \times 100{,}000 \text{ psi}} = 0.004 \text{ in.} \tag{D100}$$

This is an unrealistic size from the manufacturing point of view, so a 0.020 in. wall thickness will be used. The cylinder weight will be

$$\pi \left(0.27^2 - 0.25^2\right) 8 \ (0.29) = 0.076 \text{ lb} \tag{D101}$$

The plunger weight will be

$$\pi \ 0.625^2(10) \ 0.1 = 0.012 \text{ lb} \tag{D102}$$

Assuming that one endcap is a 0.5 in. diameter disc 0.125 in. thick and the other one is a 1 in. sphere that is 0.25 in. thick, the weight of the aluminum end-caps is

$$0.1 \left[\pi \ 0.25^2(0.125) + \frac{0.5\pi}{6} \left(1.5^3\right)\right] = 0.091 \text{ lb} \tag{D103}$$

The gas producing squibs weigh 0.2 lb each. The total actuator weight is

$$0.075 + 0.012 + 0.091 + 2(0.2) = 0.579 \text{ lb} \tag{D104}$$

Two actuators are required per wing.

Since the weight of the actuator was set by manufacturing rather than burst strength, the weight can be held constant over the range of sizes that may be required.

7. Summary

- Tensioners - two required per wing

Unbroken tensioners weight

$$= \left[\pi N\ (D_3 + Nt) + 10D_3\right] n\ 0.29\ bt + 0.449 \qquad \text{(D91)}$$

Broken tensioners weight = $Ws_1 + Ws_2 + Ws_3 + Ws_4 + 0.288$, (D94)

where

$$Ws = 4\left[\pi \frac{N}{4}\left(D_3 + \frac{N}{4}t\right) + 10D_3\right] bt\ 0.29 \qquad \text{(D89a)}$$

- Slip ring assembly

Slip ring assembly weight = $0.0739P + 5.51$ (D95)

- Drum bearing

$$Wb = 0.0127T + 1.28 \qquad \text{(D96)}$$

- Mast sleeve

$$Wc = \pi D'\left(5.14 \times 10^{-4} L + 0.125\right) \qquad \text{(D96a)}$$

- Latches

  0.044 lb constant unbroken array

  0.252 lb constant broken array

- Drum deployment actuators

  1.158 lb constant

- Drum bearing

$$Wb = 0.0127T + 1.28 \tag{D95}$$

- Mast sleeve

$$Wc = \pi D' \, (5.14 \times 10^{-4}L + 0.125) \tag{D95a}$$

- Latches

  0.044 lb constant unbroken array

  0.252 lb constant broken array

- Drum deployment actuators

  1.158 lb constant

APPENDIX D

SECTION II

PART 1

FREQUENCY EQUATIONS FOR THE LMSC FOLDOUT ARRAY

APPENDIX D

SECTION II — PART 1

FREQUENCY EQUATIONS FOR THE LMSC FOLDOUT CONCEPT

The derivation of the frequency equations for the foldout concept is contained in Reference 3. The derivation is repeated here only in the interest of completeness. The first lowest bending mode and torsional mode is estimated using energy methods.

1. Estimation of First System Bending Mode

Assume that the boom/blanket combination of the array deformed as shown in Figure D16. Then the boom deflection y and the blanket deflected shape z can be expressed as

$$y = \delta \left(1 - \cos \frac{\pi x}{2L}\right) \tag{D105}$$

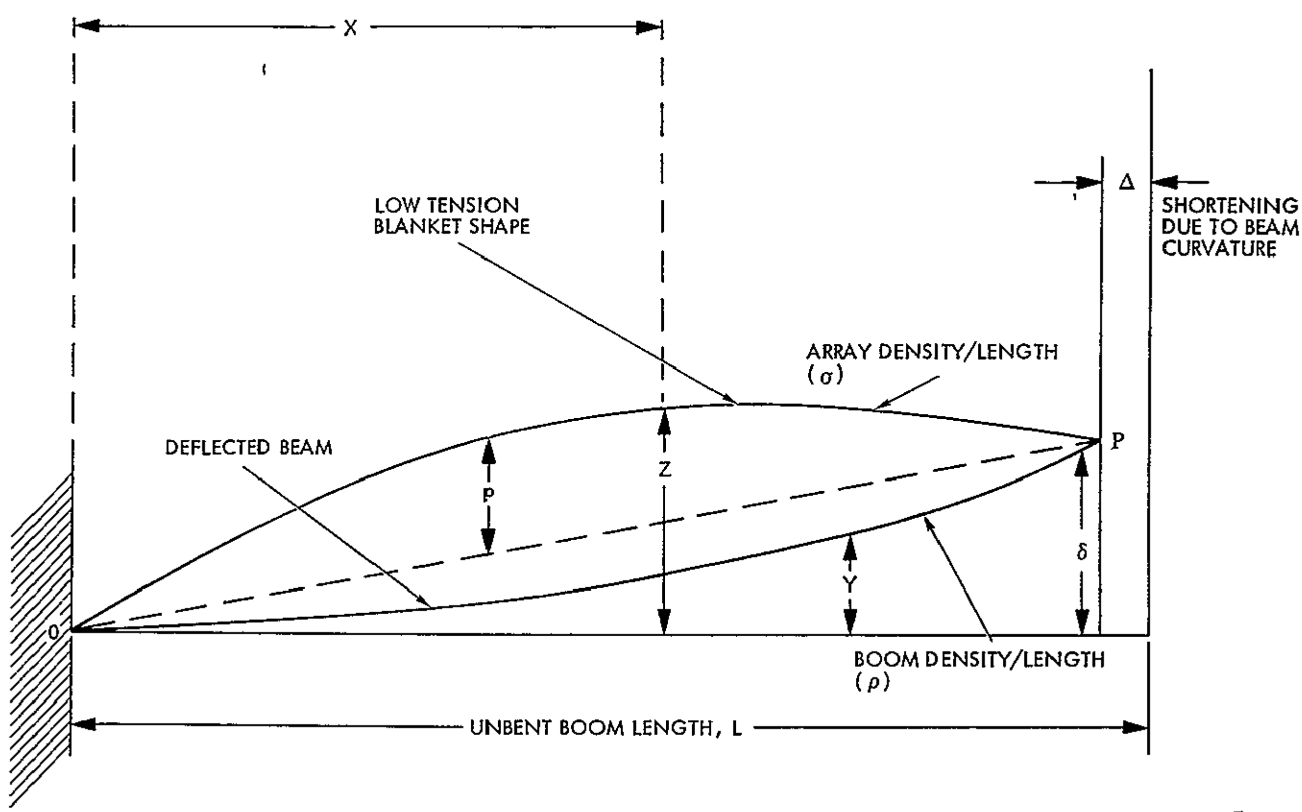


Figure D16. Boom Tension

$$z = \delta \frac{x}{L} + p = \delta \frac{x}{L} + A \sin \frac{\pi x}{L} \tag{D106}$$

The strain energy of the boom, V_B, can be expressed as

$$V_B = \frac{\overline{EI}}{2}\int (y'')^2 \, dx = \frac{\overline{EI}}{2} \int_o^L \delta^2 \frac{\pi^4}{16L^4} \cos^2 \frac{\pi x}{2L} \, dx$$

$$= \frac{\overline{EI}}{2} \cdot \frac{\pi^4}{16L^4} \cdot \frac{\delta^2}{2} \int_o^L \left(1 + \cos \frac{\pi x}{L}\right) dx = \frac{\pi^4 \, \overline{EI} \, \delta^2}{64L^3} \tag{D107}$$

and the shortening of the boom, Δ, due to the deflection δ

$$\Delta = \frac{1}{2} \int_o^L \left(\frac{dy}{dx}\right)^2 dx = \frac{1}{2} \int_o^L \frac{\delta^2\pi^2}{4L^2} \sin^2 \frac{\pi x}{2L} \, dx$$

$$= \frac{\delta^2\pi^2}{8L^2} \cdot \frac{1}{2} \int_o^L \left(1 - \cos \frac{\pi x}{L}\right) dx = \frac{\delta^2\pi^2}{16L}; \qquad OP = L - \frac{\delta^2\pi^2}{16L} \tag{D108}$$

The length of the curved array path $\widehat{OP}$ can be expressed as

$$\widehat{OP} = \frac{1}{2}\int \left(\frac{dp}{dx}\right)^2 dx + OP = \frac{1}{2}\int \frac{A^2\pi^2}{L^2} \cos^2 \frac{\pi x}{L} \, dx + L - \frac{\delta^2\pi^2}{16L}$$

$$= \frac{\pi^2 A^2}{4L^2} \int_o^L \left(1 + \cos \frac{2\pi x}{L}\right) dx + L - \frac{\delta^2\pi^2}{16L} \tag{D109}$$

$$= \frac{\pi^2 A^2}{4L} + L - \frac{\delta^2\pi^2}{16L}$$

The stretch of the array, S_A,

$$S_A = \frac{\pi^2}{4L} \left(A^2 - \frac{\delta^2}{4}\right) \tag{D110}$$

and the strain energy of the array, V_A,

$$V_A = \frac{T\pi^2}{4L} \left(A^2 - \frac{\delta^2}{4}\right) \tag{D111}$$

The kinetic energy of the boom, K_B

$$K_B = \frac{\rho\omega^2}{2g} \int \delta^2 \left(1 - \cos \frac{\pi x}{2L}\right)^2 dx$$

$$= \frac{\rho\omega^2}{2g} \delta^2 \int_o^L \left(1 - 2 \cos \frac{\pi x}{2L} + \cos^2 \frac{\pi x}{2L}\right) dx \tag{D112}$$

$$= \frac{\rho\omega^2\delta^2}{2g} \left[L - \frac{4L}{\pi} + \frac{L}{2}\right] = \frac{0.227 \; \rho\omega^2\delta^2 L}{2g}$$

The kinetic energy of the outboard support, K_{OS}

$$K_{OS} = \frac{M\omega^2\delta^2}{2} \tag{D113}$$

The kinetic energy of the array, K_A

$$K_A = \frac{\sigma\omega^2}{2g} \int \left(\frac{\delta x}{2} + A \sin \frac{\pi x}{2}\right)^2 dx$$

$$= \frac{\sigma\omega^2}{2g} \int_o^L \left(\frac{\delta^2 x^2}{L^2} + \frac{2\delta x A}{L} \sin \frac{\pi x}{L} + A^2 \sin^2 \frac{\pi x}{2}\right) dx$$

(D114)

$$= \frac{\sigma\omega^2}{2g} \left[\frac{\delta^2 L}{3} + \frac{2\delta A}{L} \left(-x \cdot \frac{L}{\pi} \cos \frac{\pi x}{L} + \int \frac{L}{\pi} \cos \frac{\pi n}{L} dx\right)\right.$$

$$\left. + \frac{A^2}{2} \int \left(1 - \cos \frac{2\pi x}{L} \; dx\right) \right]$$

$$= \frac{\sigma\omega^2}{2g} \left[\frac{\delta^2 L}{3} + \frac{2\delta A}{L} \cdot \frac{L^2}{\pi} + \frac{A^2 L}{2}\right] = \frac{\sigma\omega^2}{2g} \left[\frac{\delta^2 L}{3} + \frac{2\delta A L}{\pi} + \frac{A^2 L}{2}\right]$$

Equating the strain energy to the kinetic energy the following relationship is obtained:

$$\frac{\pi^4 \ EI \ \delta^2}{64L^3} + \frac{T\pi^2}{4L} \left(A^2 - \frac{\delta^2}{4}\right) = \frac{0.227 \ \rho\omega^2 \ \delta^2 L}{2g} \tag{D115}$$

$$+ \frac{M\omega^2 \ \delta^2}{2} + \frac{\sigma\omega^2}{2g} \left[\frac{\delta^2 L}{3} + \frac{2\delta AL}{\pi} + \frac{A^2 L}{2}\right]$$

A relationship between A and δ must be sought. Moments about Point 0 of forces on array equal zero.

$$\int \omega^2 \frac{Z\sigma}{g} \ x \ dx = T\delta - T \left(\frac{dz}{dx}\right)_{(X=L)} L$$

$$\therefore \quad \frac{\omega^2\sigma}{g} \int_o^L \left(\delta \frac{x^2}{L} + Ax \ \sin \frac{\pi x}{L}\right) dx = T\delta - TL \left(\frac{\delta}{L} - \frac{A\pi}{L}\right) \tag{D116}$$

$$\therefore \quad \frac{\omega^2\sigma}{g} \left[\frac{\delta L^2}{3} + A \left(- \frac{Lx}{\pi} \cos \frac{\pi x}{L} + \int \frac{L}{\pi} \cos \frac{\pi x}{L} \ dx\right)\right] = TA\pi$$

$$\therefore \quad \frac{\omega^2\sigma}{g} \left[\frac{\delta L^3}{3} + \frac{AL^2}{\pi}\right] = TA\pi$$

$$A = \frac{\delta L^2}{3 \left(\frac{T\pi g}{\omega^2\sigma} - \frac{L^2}{\pi}\right)} \tag{D117}$$

In the above derivation the geometry is defined in Figure D16. The other variables are defined as follows:

$\overline{EI}$ = Boom Stiffness

M = Outboard Mass

T = Tension

ρ = Boom Weight Density/Length

σ = Array Weight Density/Length

ω = Circular Frequency, Rad/Sec.

All above must have consistent units. It is desired to minimize boom weight, thus a relationship between $\overline{EI}$ and T is sought to minimize $\overline{EI}$ and hence, boom weight.

Using Equation (D115) to find

$$\frac{d(\overline{EI})}{dT} = 0$$

Let

$$\sigma' = \frac{\sigma}{g}$$

$$\rho' = \frac{\rho}{g}$$

$$a = \frac{A}{\delta}$$

$$\Omega = \sigma'\omega^2 L \qquad \text{(D118)}$$

$$\tau = \frac{T\pi^2}{4L}$$

$$B = -\frac{\pi^4}{64L^3}$$

$$C = \frac{0.227\ \rho'\omega^2 L}{2} + \frac{M\omega^2}{2} + \frac{\sigma'\omega^2 L}{6}$$

Then Equation (D115) simplifies to

$$-\frac{\tau}{4} + \left(\tau - \frac{\Omega}{4}\right) a^2 - \frac{\Omega}{4} a = B\overline{EI} + C \qquad \text{(D119)}$$

Differentiate the above

$$\frac{d\overline{EI}}{d\tau} = 0 \tag{D120}$$

$$- \frac{1}{4} + a^2 + 2a \left(\tau - \frac{\Omega}{4}\right) \frac{\partial a}{\partial \tau} - \frac{\Omega}{\pi} \frac{\partial a}{\partial \tau} = 0$$

from (D117)

$$a = \frac{L^2}{3 \left(\frac{T\pi}{\omega^2 \sigma'} - \frac{L^2}{\pi}\right)} \tag{D117a}$$

from which

$$T = \frac{\omega^2 \sigma' L^2}{3a\pi} + \frac{L^2 \omega^2 \sigma'}{\pi^2}$$

$$T = \Omega \frac{L}{3a\pi} + \Omega \frac{L}{\pi^2} = \frac{\Omega L}{\pi} \left(\frac{1}{3a} + \frac{1}{\pi}\right)$$

$$\tau = \frac{\Omega\pi}{4} \left(\frac{1}{3a} + \frac{1}{\pi}\right) \tag{D121}$$

$$\frac{\partial a}{\partial \tau} = \frac{\partial a}{\partial T} \frac{\partial T}{\partial \tau}$$

from (D117a)

$$\frac{\partial a}{\partial T} = -a^2 \frac{3\pi}{L\Omega} \qquad \frac{\partial T}{\partial \tau} = \frac{4L}{\pi^2} \qquad \frac{\partial a}{\partial \tau} = - \frac{12}{\pi\Omega} a^2 \tag{D122}$$

Substituting (D122) into (D120)

$$- \frac{1}{4} + a^2 - 2a \frac{\Omega\pi}{4} \left(\frac{1}{3a} + \frac{1}{\pi}\right) \frac{12\ a^2}{\pi\Omega} + \frac{a\Omega}{2} \cdot \frac{12}{\pi\Omega} a^2 + \frac{\Omega}{\pi} \frac{12}{\pi\Omega} a^2 = 0$$

or

$$- \frac{1}{4} + a^2 - 6a^3 \left(\frac{1}{3a} + \frac{1}{\pi}\right) + \frac{6}{\pi} a^3 + \frac{12}{\pi^2} a^2 = 0 \tag{D123}$$

$$a = \frac{1}{2\sqrt{\frac{12}{\pi^2} - 1}} = 1.0762 \tag{D124}$$

Substituting a into the expression for T gives

$$T_{MIN\ \overline{EI}} = \frac{1.97306\ \omega^2 \sigma' L^2}{\pi^2} = 0.1999\ \omega^2 \sigma' L^2 \tag{D125}$$

and

$$\overline{EI}_{MIN} = 0.23048\ L^4 \omega^2 \left(0.3207\rho' + \frac{1.4254M}{L} + \sigma'\right) \tag{D126}$$

2. Estimation of First System Torsion Mode

Figure D17 shows the system deformed in torsion

$$\phi = \frac{x\theta}{L} \tag{D127}$$

The membrane tension is T'/unit chord

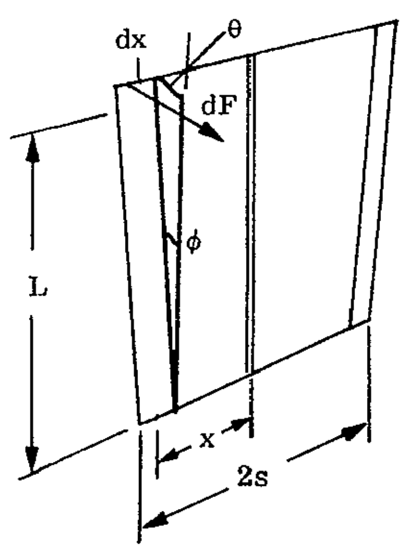


Figure D17. Torsional Deformation of Array

The lateral component of force on element dx of leading edge member is:

$$dF = T' \, x \, \theta dx/L \tag{D128}$$

Potential energy associated with this is:

$$dV_1 = \frac{1}{2} (T'x\theta dx/L) \cdot x\theta = \frac{T'\theta^2}{2L} x^2 \, dx \tag{D129}$$

Total potential energy for whole array blanket

$$V_1 = \frac{T'\theta^2}{2L} \int_{-s}^{s} x^2 \, dx = \frac{T'\theta^2 s^3}{3L} \tag{D130}$$

Potential energy of central mast, S_M

$$S_M = \frac{GJ\theta^2}{2L} \tag{D131}$$

Kinetic energy of element dydx located at (x, y)

$$\frac{\sigma_o}{2} \int_o^L \int_{-s}^{s} \left(\frac{\omega \cdot xy\theta}{L}\right)^2 dxdy \qquad \sigma_o = \text{mass/unit area}$$

$$= \frac{\omega^2 \sigma_o \theta^2}{2L^2} \int_o^L \int_{-s}^{s} x^2 y^2 \, dxdy$$

$$= \frac{\omega^2 \sigma_o \theta^2}{2L^2} \cdot \frac{2s^3}{3} \cdot \frac{L^3}{3} = \frac{\omega^2 \sigma_o L s^3 \theta^2}{9} \tag{D132}$$

Kinetic energy of outboard support, K_{OS}

$$K_{OS} = \frac{1}{2} I \, (\omega\theta)^2 \tag{D133}$$

Equating potential energy to kinetic energy

$$\frac{T's^3}{3L} + \frac{GJ}{2} = \omega^2 \left[\frac{\sigma_o Ls^3}{9} + \frac{I}{2} \right]$$

(D134)

$$\omega^2 = \frac{\left(\frac{T's^3}{3L} + \frac{GJ}{2L} \right)}{\left(\frac{\sigma_o Ls^3}{9} + \frac{I}{2} \right)}$$

or

$$f^2 = \frac{1}{4\pi^2} \quad \frac{\left(\frac{T's^3}{3L} + \frac{GJ}{2L} \right)}{\left(\frac{\sigma_o Ls^3}{9} + \frac{I}{2} \right)} \tag{D134a}$$

where

T' = Membrane tension/unit width

L = Length

GJ = Torsional rigidity of mast

σ_o = Membrane mass density/unit area

2s = Width of complete array blanket

I = Mass moment of inertia of outboard support member about mast long. axis

f = Frequency, Hz

ω = Circular frequency, rad/sec

3. Catenary Frequency of Stretched Membrane

From Reference 3 the catenary frequency of the stretched membrane is given by:

$$f = \frac{0.5}{L} \sqrt{\frac{T'}{\sigma_o}} \text{ Hz} \tag{D135}$$

where

L = Length

T' = Tension/unit width

σ_o = Mass Density/unit area

f = Frequency, Hz

APPENDIX D

SECTION II

PART 2

FREQUENCY EQUATIONS FOR THE GE ROLLOUT CONCEPT

Dr. J.C. Chen

APPENDIX D

SECTION II — PART 2

FREQUENCY EQUATIONS FOR THE GE ROLLOUT CONCEPT

The derivation of the frequency equations for the rollout concept follows the Rayleigh-Ritz energy approach used in Part 1 and documented in Reference 3. Due to the different configuration of the blanket and the out of plane stiffness induced by V-stiffening the frequency equations differ substantially from the flat foldout concept.

The frequency for the lowest bending and torsional modes will be estimated using energy methods.

1. ESTIMATION OF THE FIRST SYSTEM BENDING MODE

The lowest bending mode frequency will be obtained by the energy method,

STRAIN ENERGY = KINETIC ENERGY

where strain energy includes the bending of the boom and stretching of the blanket. The kinetic energy is derived from motions of the boom, the outboard support and the array.

Let y(x) and p(x) be the traverse vibration mode shapes of the boom and the blanket, respectively.

$$V_B \;=\; \text{strain energy of boom bending} = \frac{\overline{EI}}{2} \int_o^L \left(\frac{d^2y}{dx^2}\right)^2 dx \qquad \text{(D136)}$$

$V_B \;=\;$ strain energy of blanket stretching

$$= T\left[\frac{1}{2} \int_o^L \left(\frac{dp}{dx}\right)^2 dx - \frac{1}{2} \int_o^L \left(\frac{dy}{dx}\right)^2 dx\right] \qquad \text{(D137)}$$

$$(KE)_B \;=\; \text{kinetic energy of the boom} = \frac{\rho\omega^2}{2g} \int_o^L y^2\, dx \qquad \text{(D138)}$$

$$(KE)_o \;=\; \text{kinetic energy of the outboard support} = \frac{M_o \omega^2 \delta^2}{2} \tag{D139}$$

$$(KE)_A \;=\; \text{kinetic energy of the array} = \frac{\sigma\omega^2}{2g} \int_o^L \left[\frac{\delta}{L}\, x + p(x)\right]^2 dx \tag{D140}$$

Where

$\overline{EI}$ = bending rigidity of the boom

ρ = boom density

M_o = outboard mass

L = length of the boom and blanket

σ = array density

ω = circular frequency, rad/sec

The boom mode shape will be assumed to be the same as the static boom characteristic with tip constraint. This relationship is based on test data and is derived in Reference 20.

The boom static deflection curve has been derived as

$$y(x) = \delta[A \sin\gamma x + B \cos\gamma x + Gx + H] \tag{D141}$$

where

$$A = \frac{\gamma L \sin\gamma L + \cos \gamma L - 1}{\gamma L(2-2 \cos\gamma L - \gamma L \sin\gamma L + \Gamma\gamma L \sin\gamma L - \gamma^2 L^2 \Gamma \cos\gamma L)} \tag{D142}$$

$$B = \frac{\gamma L \cos\gamma L - \sin\gamma L}{\gamma L(2-2 \cos\gamma L - \gamma L \sin\gamma L + \Gamma\gamma L \sin\gamma L - \gamma^2 L^2 \Gamma \cos\gamma L)} \tag{D143}$$

$$G = -\gamma A \quad , \quad H = -B \tag{D144}$$

$$\gamma^2 = \frac{T}{\overline{EI}}$$

T = Total pre-tension force in the blanket

K_R = Boom Root spring constant

$$\Gamma = \frac{\overline{\overline{EI}}}{K_R L}$$

The blanket mode shape will be assumed as

$$p(x) = \alpha \sin\left(\frac{\pi x}{L}\right) \tag{D145}$$

both δ and α are undetermined amplitudes, however they are related through the balance of moment on array.

Neglecting the cant angle β the relationship between α and δ can be established using the same arguments as for the LMSC foldout array, Reference 3.

$$\frac{\alpha}{\delta} = \frac{L^2}{3\left(\frac{T\pi g}{\omega^2 \sigma} - \frac{L^2}{\pi}\right)} \tag{D146}$$

The displacement functions $y(x)$ and $p(x)$ are taken from the static deflection shape, Reference 20, they satisfy the following boundary conditions,

$$y = 0 \quad , \quad \frac{dy}{dx} = \frac{\overline{\overline{EI}}}{K_R} \quad , \quad \frac{d^2y}{dx^2} \quad \text{at} \quad x = 0$$

$$y = \delta \quad , \quad \frac{dy}{dx} = \frac{\delta}{L} \quad \text{at} \quad x = L$$

and

$$p = \frac{d^2p}{dx^2} = 0 \quad \text{at} \quad x = 0, \; L$$

Carrying out the integration, the following are obtained

$$V_B = \frac{1}{2}\, \overline{\overline{EI}}\gamma^3 \cdot \eta_1 \delta^2 \tag{D147}$$

$$V_A = T\left(\frac{\pi^2\alpha^2}{4L} - \frac{\gamma}{2}\eta_2\delta^2\right) \tag{D148}$$

$$(KE)_B = \frac{1}{2\gamma}\frac{\rho\omega^2}{g}\cdot\eta_3\delta^2 \tag{D149}$$

$$(KE)_A = \frac{\sigma\omega^2}{2g}\left[\frac{L\delta^2}{3} + \frac{2L\alpha\delta}{\pi} + \frac{L\delta^2}{2}\right] \tag{D150}$$

where

$$\eta_1 = \frac{1}{2}\gamma L(A^2+B^2) - \frac{1}{4}(A^2-B^2)\sin(2\gamma L) + AB\sin^2(\gamma L) \tag{D151}$$

$$\begin{aligned}\eta_2 = {} & \frac{1}{2}\gamma L(A^2+B^2) + \frac{1}{4}(A^2-B^2)\sin(2\gamma L) - AB\sin^2(\gamma L) \\ & -2A^2\sin(\gamma L) - 2AB\cos(\gamma L) + 2AB + \gamma LA^2\end{aligned} \tag{D152}$$

$$\begin{aligned}\eta_3 = {} & \frac{1}{4}(B^2-A^2)\sin(2\gamma L) - 2(A^2+B^2+\gamma LAB)\sin(\gamma L) \\ & + 2\gamma LA^2\cos(\gamma L) - AB\cos^2(\gamma L) + \gamma LA^2\left(\frac{1}{2}+\frac{1}{3}\gamma^2L^2\right) \\ & + AB(1+\gamma^2L^2) + \frac{3}{2}\gamma LB^2\end{aligned} \tag{D153}$$

Now let

$$V_B + V_A = (KE)_B + (KE)_o + (KE)_A \tag{D154}$$

$$\omega^2 = \frac{\dfrac{T}{L}\left\{\dfrac{\gamma L}{2}(\eta_1-\eta_2) + \pi^2\dfrac{\alpha^2}{4\delta^2}\right\}}{\dfrac{1}{2}\left\{M_o + M_B\dfrac{\eta_3}{\gamma L} + M_A\left(\dfrac{1}{3}+\dfrac{2\alpha}{\pi\delta}+\dfrac{\alpha^2}{2\delta^2}\right)\right\}} \tag{D155}$$

where

M_B = Boom mass = $\rho L/g$

M_A = Array mass = $\sigma L/g$

Using previously obtained relationship for α/δ, one obtains:

$$\frac{1}{2}\left(\frac{\pi^2}{18} - \frac{2}{3} + \overline{M}\right) \lambda^3 + \left(\frac{1}{3} - \overline{M} - \frac{\pi^2}{36} - \overline{\eta}\right) \lambda_o \lambda^2 + \left(\frac{1}{2}\,\overline{M} + 2\overline{\eta}\right) \lambda_o^2 \lambda - \overline{\eta}\lambda_o^3 = 0 \qquad \text{(D156)}$$

where

$$\lambda = \omega^2$$

$$\lambda_o = \frac{\pi^2 T}{M_A L}$$

$$\overline{M} = \frac{\eta_3}{\gamma L}\frac{M_B}{M_A} + \frac{M_o}{M_A} + \frac{1}{3} \qquad \text{(D157)}$$

$$\overline{\eta} = \frac{\gamma L}{\pi^2}\left(\frac{1}{2}\,\eta_1 - \eta_2\right)$$

Equation (D156) has to be solved for the first mode bending frequency.

2. ESTIMATION OF THE FIRST SYSTEM TORSION MODE

The derivation for the lowest system torsion mode follows the method developed in Reference 3, summarized in Section II, Part 1 of this appendix. Thus

$$V_A = \text{Strain energy of the array} = \frac{T' w^3 \theta^2}{3L} \qquad \text{(D158)}$$

$$(KE)_A = \text{Kinetic energy of the array} = \frac{\omega^2 \sigma L w^3 \theta^2}{9} \qquad \text{(D159)}$$

$$(KE)_o = \text{Kinetic energy of the outboard mass} = \frac{1}{2} I\ (\omega\theta)^2 \quad \text{(D160)}$$

where

T' = tension per unit width of blanket

σ = array mass density per unit area

w = width of the array

L = length of the array

The twisting of the array induces boom bending, Figure D18.

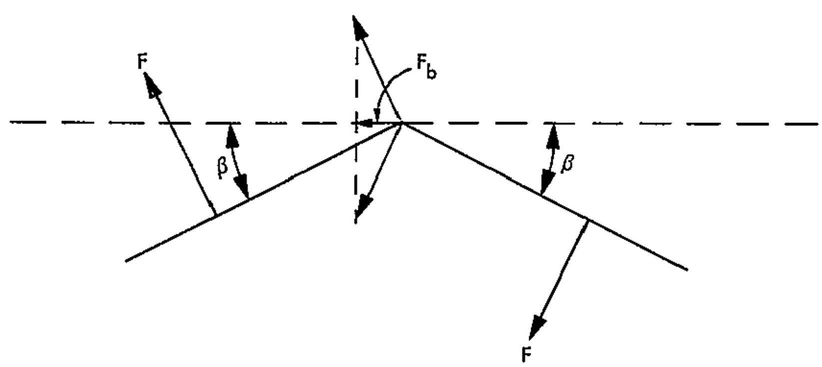


Figure D18.

$$F = \int_o^w dF = \int_o^w T'X\theta \frac{dx}{L} = \frac{1}{2} T' \frac{w^2}{L} \theta$$

$$F_b = \text{bending force} = 2\ F \sin\beta = T' \frac{w^2}{L} \theta \sin\beta$$

The boom force deflection relationship for boom inplane bending has been derived in Reference 9.

$$F_b = \left(\frac{4\overline{EI}}{L^3} - \frac{4T'w}{15L}\right) \cdot \delta \quad \text{(D161)}$$

V_B = boom bending strain energy

$$V_B = \frac{1}{2} F_b \cdot \delta = \frac{1}{2} F_b^2 \frac{1}{\left(\frac{4\overline{EI}}{L^3} - \frac{4T'w}{15L}\right)} = \frac{1}{2} \frac{\left(T' \frac{w^2}{L} \theta\right)^2 \sin^2 \beta}{\left(\frac{4\overline{EI}}{L^3} - \frac{4T'w}{15L}\right)} \tag{D162}$$

KINETIC ENERGY OF THE BOOM

$$(KE)_B = \frac{\rho\omega^2}{2g} \int_o^L y^2 dx = \frac{1}{2\gamma} \frac{\rho\omega^2}{g} \eta_3 \delta^2$$

$$= \frac{\eta_3}{2\gamma} \frac{\rho\omega^2}{g} \frac{\left(T' \frac{w^2}{L} \theta\right)^2 \sin^2 \beta}{\left(\frac{4\overline{EI}}{L^3} - \frac{4T'w}{15L}\right)^2} \tag{D163}$$

where

ρ = weight density of the boom (lb/unit length)

η_3 = parameter defined in bending frequency derivation, see previous section

$\gamma^2 = \frac{T}{\overline{EI}}$

$\overline{EI}$ = boom bending stiffness

$(KE)_o$ = kinetic energy of outboard support

$$= \frac{M_o \omega^2 \delta^2}{2} + \frac{1}{2} I (\omega\theta)^2 \tag{D164}$$

$$= \frac{M_o \omega^2}{2} \frac{\left(T' \frac{w^2}{L} \theta\right)^2 \sin^2 \beta}{\left(\frac{4\overline{EI}}{L^3} - \frac{4T'w}{15L}\right)^2} + \frac{1}{2} I (\omega\theta)^2 \tag{D165}$$

where I = moment of inertia of the outboard support. Let

$$V_A + V_B = (KE)_A + (KE)_B + (KE)_o \tag{D166}$$

and

$2T'w$ = Total tension in two blankets = T

$2\sigma Lw = M_A$ = Total array mass

Then

$$\omega^2 = \frac{T\left[\frac{1}{3} + \frac{(\gamma L)^2 \sin^2 \beta}{8\left(2 - \frac{\gamma^2 L^2}{15}\right)}\right]}{L\left\{\frac{I}{w^2} + \frac{1}{9} M_A + \frac{(\gamma L)^3 \sin^2 \beta}{16\left(2 - \frac{\gamma^2 L^2}{15}\right)^2}(\eta_3 M_B + \gamma L M_o)\right\}} \qquad \text{(D167)}$$

where

ω is the circular frequency in radians/seconds

β is the cant angle

I is the moment inertia of the outboard mass about the boom centerline, and γ, w, M_A, M_B, M_o and η_3 have been defined in the previous section as part of the derivation for the lowest bending mode.

3. CATENARY FREQUENCY OF STRETCHED MEMBRANE

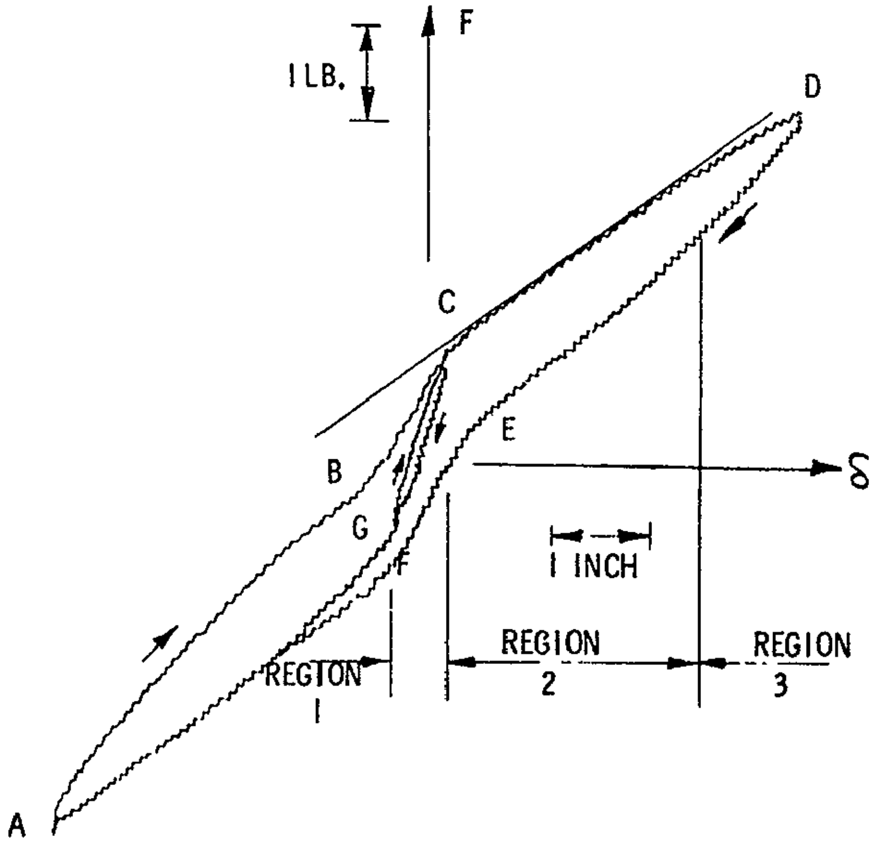
The catenary frequency of the stretched membrane is identical to that derived in Reference 3 for the foldout array, see Section II, Part 1 of this appendix.

4. DIFFERENCES BETWEEN THE APPROACH USED BY GE FOR ESTIMATING ROLLOUT FREQUENCIES AND THE ASSUMPTIONS USED IN THE DERIVATION OF THE EQUATIONS

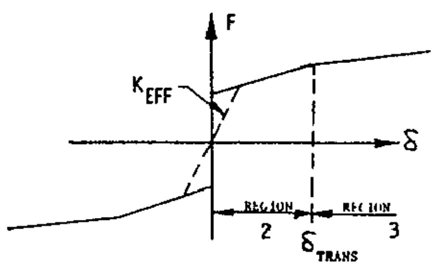
The GE program for the estimation of array frequencies is proprietary and the GE approach can only be inferred from the published reports, such as Reference 9.

The approach for obtaining the lowest system bending frequency as used by GE will be interpreted here for completeness and for purposes of comparison between the GE approach and that used to develop the equations for this study. The approach used by GE is to use the test data for the inplane blanket/boom

combination to obtain an effective out-of-plane spring constant. The test data relating tip deflection to tip force is shown in Figure D19(a). Figure D19(b) shows the equivalent linearized model.



(a) Measured



(b) Linearized

Figure D19. In-Plane Force-Deflection Characteristic for Rollout Array

Since it is assumed that the array operates in a gravity field and furthermore since the transition from Region 1 to Region 2 is not fully understood, only Region 2 is of interest. Reference 9 gives the equivalent spring constant, of a linear spring acting as the tip of the boom as

$$K_{eff} = \frac{4\overline{EI}}{L^3} - \frac{4T}{15L} + \frac{T\ w\ \sin\beta}{L}\frac{1}{\delta} \tag{D168}$$

where β is the cant angle. K_{eff} is evaluated at a value of δ which corresponds to the static deflection of the array under the gravity loading. This K_{eff} represents an average spring constant for a particular loading, Figure D19(b). The array is then analyzed as a flat array with a tip spring to ground acting perpendicular to the array.

The derivation leading to Equation (D156) uses a different approach. The basis for this derivation rests on the assumption that the slope of Region 2 should be used for the spring constant and not an effective spring constant. It is assumed that the array will have deflected to some δ_0 under gravity and that it will be oscillating about that position. In deriving the energy relationships for the frequency equation the static deflection curve for the boom was used. It should be noted that the frequency of the lowest bending mode obtained in this fashion is independent of the cant angle. Thus the advantage of the V-stiffening array in bending lies in the increase in bending stiffness of the boom and not on the size of the cant angle. The cant angle does enter the equation for the calculation of the torsional frequency.

APPENDIX D

SECTION II - PART 3

FREQUENCY EQUATIONS FOR POSITION BOOM SCALING

The derivation of the equations for scaling the position boom are based on the solution of a two degree of freedom linear vibration system. The solution is approximate based on the comcept of effective mass, References 24 and 25.

Given the requirement that the system frequency of a solar array wing shall not be lower than $\overline{\omega}_s$ radians/second and a position boom length ℓ_p it is desired to find a combination of array frequency ω_a, boom bending stiffness $\overline{EI_p}$, boom torsion stiffness, $\overline{JG_p}$ and boom weight, W_p, such that the calculated system frequency, ω_s meets or exceeds $\overline{\omega}_s$.

The solution to the above problem is not unique, but for practical applications the requirements can be satisfied by iteration to seek a minimum volume, or weight constraint.

1. ESTIMATION OF THE POSITION BOOM BENDING STIFFNESS REQUIREMENT

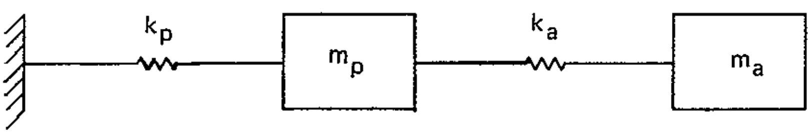


Figure D20. Two Degree of Freedom Spring-Mass System Representing The Position Boom and Array.

The two degree of freedom system shown in Figure D20 has the following frequency equation

$$\Omega^4 - \left(\frac{k_p + k_a}{m_p} + \frac{k_a}{m_a}\right)\Omega^2 + \frac{k_a\,k_p}{m_a\,m_p} = 0 \qquad \text{(D169)}$$

where

$$\Omega = \omega_s$$

and the k's and m's are the effective spring and mass for the array and position boom, respectively.

Define

$$\omega_a^2 = \frac{k_a}{m_a}, \tag{D170}$$

$$\omega_p^2 = \frac{k_p}{m_p}$$

which leads to

$$\Omega^4 - \left[\omega_p^2 + \omega_a^2 \left(1 + \frac{m_a}{m_p}\right)\right] \Omega^2 + \omega_a^2\, \omega_p^2 = 0 \tag{D171}$$

Equation (D170) has a solution for the lowest system frequency given by

$$\omega_s = \left\{\frac{1}{2}\left[\omega_p^2 + \frac{m_a}{m_p}\,\omega_a^2\right] - \frac{1}{2}\sqrt{\left(\omega_p^2 + \frac{m_a}{m_p}\,\omega_a^2\right)^2 - 4\omega_a^2\,\omega_p^2}\right\}^{1/2} \tag{D172}$$

For sizing the bending boom stiffness it will be assumed that the first array bending mode, ω_a^B, accounts for 50% of the array mass, then

$$\omega_p^B = \sqrt{\frac{3\,\overline{EI}_p}{\ell_p^3\,(0.23\,M_p + 0.5\,M_a)}} \tag{D173}$$

where

M_p is the actual total mass of the position boom.

M_a is the actual total mass of the solar array.

and all other symbols have been determined previously. Equation (D173) is used with Equation (D172) as follows: For a given $\overline{\omega}_s$ and ℓ_p a trial value of $\overline{EI}_p$ and $\omega_a^B > \overline{\omega}_s$ is picked; ω_a^B and the array width determine M_a from the plots of Section XI, assuming that the first bending mode exhibits the lowest frequency of the array, the value of M_p can be estimated from the position boom design which determined $\overline{EI}_p$. Equations (D172) and (D173) are used to iterate until a satis-

factory combination of $\overline{EI}_p$ and ω_a^B are found, subject to volume, weight or strength constraints. In evaluating Equation (D172) the following should be used for the ratio M_a/M_p:

$$\frac{m_a}{m_p} \approx \frac{M_a}{0.46\ M_p + M_a} \qquad \text{(D174)}$$

2. ESTIMATION OF POSITION BOOM TORSION STIFFNESS REQUIREMENT

The position boom torsion stiffness scaling required that the array/position boom combined torsion frequency exceed the required system frequency, $\overline{\omega}_s$. It will be assumed that the first array torsion elastic mode accounts for 30% of the array inertia. Then the position boom frequency in torsion with an equivalent array can be estimated as

$$\omega_T^2 = \frac{\overline{JG}_p}{0.7\ I_a\ \ell_p} \qquad \text{(D175)}$$

where

ω_T is the circular torsion frequency rad/sec

J position boom solar moment of inertia

G_p position boom shear modulus

I_a array mass moment of inertia about boom axis

Assuming that the position boom acts as a massless spring in series between the array and the attachment point the system frequency can be estimated as

$$\omega_s = \frac{\omega_T\ \omega_a^T}{\sqrt{\omega_T^2 + \omega_a^{T^2}}} \qquad \text{(D176)}$$

where ω_a^T is the array torsion circular frequency rad/sec.

The procedure is the same as for sizing the boom in bending. It should be noted that if no better information is available the trial ω_a will be used for both ω_a^B and ω_a^T for a conservative estimate. If better information is available, such as from the detailed printout of Appendix E. The actual estimated values for ω_a^B and ω_a^T can be used for a more realistic estimate.

APPENDIX E

COMPUTER OUTPUT OF PARAMETRIC DATA

CONTENTS

APPENDIX E

COMPUTER OUTPUT OF PARAMETRIC DATA

This section contains the detailed computer printout for a selected number of configurations. Since it was impractical to show plots of all pertinent data, only a selected set of data points was chosen for printout. Enough of these data points are presented such that linear interpolation can be used to estimate values for configurations not listed.

The output is grouped by power level/wing and array width. The data for each combination of power level/wing and array width fill one page. The output consists of detailed weight lists for all components, boom and canister properties, array moment of inertia, and torsion and bending frequencies.

I. Foldout Array

1. Input Parameters

The input parameters to the foldout array computer program was as follows:

Blanket power density	0.000064 kW/in.^{2} (0.0989 kW/m^2)
Blanket weight density	0.00128 lb/in.^{2} (0.895 kg/m^2)
Weight contingency factors:	
Blanket	1.05
All other components	1.15
Acceleration field	10^{-3} g

Note that the acceleration is used to determine the boom strength capability ratio. The curves of Section X do contain data points for cases where the capability ratio is below one.

2. Output Data

Most of the output data are self-explanatory and all units are identified in the printout. Some output parameters which need clarification follow:

Aspect ratio	Defined as overall length over overall width.
Center of gravity	Measured from the fixed edge of the array outboard along the boom axis.

Blanket tension	Total blanket tension. Sum of all tensions produced by mechanisms.
Moment of inertia	The larger inertia (I1) is about an axis located at the base of the array along the width of the array. The smaller inertia (I2) is about an axis running along the extension mast. The units are lb-in.^{2}
Buckling capability ratio	Capability ratio based on overall buckling of the mast or local buckling of the longerons, whichever is smaller. Accounts for eccentric loading on mast.
Strength capability ratio	Based on strength capability of mast in acceleration field.
Abbreviations:	BX Box CR Cruise CVR Cover

II. Rollout Array

1. Input Parameters

The input parameters to the rollout array are as follows:

Blanket power density 0.0000900 kW/in.^{2} (0.139 kW/m^2)

Blanket weight density 0.000523 lb/in.^{2} (0.368 kg/m^2)

Weight contingency factors:

Blanket	1.05
Other components	1.15
Acceleration field	10^{-3} g
Cant angle, β	5 deg
Boom parameter	$\overline{\gamma} = \ell_B \sqrt{\frac{T}{\overline{EI}}} = 2.63$

where

ℓ_B = boom length, in.

T = total axial boom load, lb

$\overline{EI}$ = boom bending stiffness, lb-in.^{2}

Clearance between boom and blanket	Approx. 13 in.

The acceleration field was used to determine the boom strength capability ratio. The data plots of Section X are not limited by strength ratios below one.

2. Output Data

Most of the output data are self-explanatory, and all units are identified in the printout. Most output parameters are the same as those for the foldout array. Only the ones that are different will be discussed here.

Blanket tension	The blanket tension is given per side, in pounds.
Buckling capability ratio	Capability ratio based on overall buckling of the mast or local buckling of the longerons, whichever is smaller. Does not account for increase in buckling capability due to V-stiffening.

I

DETAILED COMPUTER OUTPUT

FOR

FOLDOUT ARRAY

ARRAY TYPE LMSC FOLDOUT POWER/WING = 8.0 KW ARRAY WIDTH = 2.00 M

ARRAY LENGTH = 40.32 M ASPECT RATIO = 20.16 BLANKET AREA = .12500+06 IN=SQ BLANKET WEIGHT = 166.4 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.022	.022	.029	.038	.047	.056
***** TORSIONAL FREQUENCY HZ *****	.191	.191	.251	.338	.428	.520
***** BENDING FREQUENCY HZ *****	.022	.022	.029	.038	.047	.056
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	126.7	126.7	136.2	150.1	164.2	178.7
ARRAY WEIGHT (LB)	278.8	278.8	299.7	330.2	361.3	393.1
CENTER OF GRAVITY (IN)	660.8	660.8	647.1	630.2	616.0	603.7
BLANKET TENSION (LB)	3.00	3.00	5.10	9.06	14.16	20.39
MOMENT OF INERTIA I1	.2037+09	.2037+09	.2143+09	.2297+09	.2455+09	.2618+09
MOMENT OF INERTIA I2	.1143+06	.1143+06	.1146+06	.1151+06	.1158+06	.1165+06
SPECIFIC POWER (KW/KG)	.063	.063	.059	.053	.049	.045
SPECIFIC WEIGHT (KG/KW)	15.8	15.8	17.0	18.8	20.5	22.3
* BOOM PROPERTIES *						
DIAMETER (IN)	12.07	12.07	13.84	16.09	18.10	19.95
EI (LB*IN*SQ)	.99397+07	.99397+07	.17191+08	.31340+08	.50212+08	.74141+08
ROOT SPRING (LB-IN/RAD)	.1290+06	.1290+06	.1946+06	.3053+06	.4348+06	.5825+06
BUCKLING CAPABILITY RATIO	9.57	9.57	9.55	9.52	9.48	9.42
STRENGTH CAPABILITY RATIO	3.19	3.19	4.57	6.69	8.91	11.19
* CANNISTER PROPERTIES *						
HEIGHT (IN)	54.84	54.84	57.77	61.47	64.79	67.84
DIAMETER (IN)	14.25	14.25	16.34	18.98	21.36	23.54
* WEIGHTS (LB) *						
ARRAY	278.8	278.8	299.7	330.2	361.3	393.1
BOOM	39.9	39.9	52.4	70.8	89.6	108.9
CANNISTER	28.9	28.9	37.1	48.8	60.7	72.8
FULL TENSIONER	1.0	1.0	1.2	1.5	1.9	2.4
INTERMEDIATE TENSIONER	.9	.9	1.0	1.0	1.0	1.0

ORIGINAL PAGE IS
OF POOR QUALITY

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	166.4	SUPPORT STRUCTURE =	2.7	INTERCONNECT HARNESS =	8.3
BOX COVER =	7.6	BOX HINGE =	.0	COVER LATCH =	1.0
CONTAINER =	16.0	MAST TIP FITTING =	1.7	MID TENSION MECHANISM =	.01
CONT BX CRUISE LATCH =	.0	CONT BX CVR CR LATCH =	.0	CONT BX DEPLOY DEVICE =	.0
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.5		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 8.0 KW   ARRAY WIDTH = 2.50 M

ARRAY LENGTH = 32.26 M   ASPECT RATIO = 12.90   BLANKET AREA = .12500+06 IN*SQ   BLANKET WEIGHT = 166.4 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.025	.025	.029	.038	.047	.056
***** TORSIONAL FREQUENCY HZ *****	.136	.136	.159	.213	.268	.324
***** BENDING FREQUENCY HZ *****	.025	.025	.029	.038	.047	.056
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	117.2	117.2	120.8	129.2	137.7	146.3
ARRAY WEIGHT (LB)	257.9	257.9	265.8	284.2	302.9	321.9
CENTER OF GRAVITY (IN)	536.0	536.0	530.1	517.4	506.2	496.1
BLANKET TENSION (LB)	3.00	3.00	4.08	7.25	11.33	16.32
MOMENT OF INERTIA I1	.1225+09	.1225+09	.1248+09	.1303+09	.1358+09	.1414+09
MOMENT OF INERTIA I2	.1777+06	.1777+06	.1779+06	.1786+06	.1794+06	.1804+06
SPECIFIC POWER (KW/KG)	.068	.068	.066	.062	.058	.055
SPECIFIC WEIGHT (KG/KW)	14.7	14.7	15.1	16.2	17.2	18.3
* BOOM PROPERTIES *						
DIAMETER (IN)	10.74	10.74	11.62	13.46	15.11	16.61
EI (LB*IN*SQ)	.62305+07	.62305+07	.85232+07	.15372+08	.24366+08	.35595+08
ROOT SPRING (LB*IN/RAD)	.9091+05	.9091+05	.1150+06	.1790+06	.2528+06	.3359+06
BUCKLING CAPABILITY RATIO	9.00	9.00	8.92	8.73	8.53	8.33
STRENGTH CAPABILITY RATIO	3.00	3.00	3.72	5.55	7.52	9.59
* CANNISTER PROPERTIES *						
HEIGHT (IN)	45.66	45.66	47.11	50.15	52.86	55.34
DIAMETER (IN)	12.68	12.68	13.71	15.89	17.82	19.60
* WEIGHTS (LB) *						
ARRAY	257.9	257.9	265.8	284.2	302.9	321.9
BOOM	25.2	25.2	29.5	39.7	49.9	60.3
CANNISTER	22.4	22.4	25.9	33.9	42.0	50.2
FULL TENSIONER	1.0	1.0	1.1	1.4	1.7	2.1
INTERMEDIATE TENSIONER	.9	.9	.9	1.0	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	166.4	SUPPORT STRUCTURE =	2.7	INTERCONNECT HARNESS =	8.3
BOX COVER =	7.6	BOX HINGE =	.0	COVER LATCH =	1.0
CONTAINER =	16.8	MAST TIP FITTING =	1.7	MID TENSION MECHANISM =	.01
CONT BX CRUISE LATCH =	.0	CONT BX CVR CR LATCH =	.0	CONT BX DEPLOY DEVICE =	.0
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.8		

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 8.0 KW   ARRAY WIDTH = 3.00 M

ARRAY LENGTH = 26.88 M   ASPECT RATIO = 8.96   BLANKET AREA = .12500+06 IN-SQ   BLANKET WEIGHT = 166.4 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.027	.027	.029	.038	.047	.056
***** TORSIONAL FREQUENCY HZ *****	.104	.104	.111	.148	.186	.224
***** BENDING FREQUENCY HZ *****	.027	.027	.029	.038	.047	.056
*** ARRAY PROPERTIES ***						
ARRAY MASS (KG)	112.0	112.0	113.0	118.7	124.5	130.3
ARRAY WEIGHT (LB)	246.4	246.4	248.6	261.2	273.8	286.6
CENTER OF GRAVITY (IN)	451.2	451.2	449.4	439.9	431.3	423.4
BLANKET TENSION (LB)	3.00	3.00	3.40	6.04	9.44	13.60
MOMENT OF INERTIA I1	.8217+08	.8217+08	.8259+08	.8495+08	.8733+08	.8973+08
MOMENT OF INERTIA I2	.2553+06	.2553+06	.2554+06	.2563+06	.2573+06	.2584+06
SPECIFIC POWER (KW/KG)	.071	.071	.071	.067	.064	.061
SPECIFIC WEIGHT (KG/KW)	14.0	14.0	14.1	14.8	15.6	16.3
*** BOOM PROPERTIES ***						
DIAMETER (IN)	9.78	9.78	10.09	11.68	13.09	14.37
EI (LB-IN-SQ)	.42782+07	.42782+07	.48552+07	.87105+07	.13735+08	.19959+08
ROOT SPRING (LB-IN/RAD)	.6858+05	.6858+05	.7540+05	.1169+06	.1645+06	.2177+06
BUCKLING CAPABILITY RATIO	8.50	8.50	8.45	8.17	7.89	7.62
STRENGTH CAPABILITY RATIO	2.81	2.81	3.08	4.64	6.35	8.18
*** CANNISTER PROPERTIES ***						
HEIGHT (IN)	39.42	39.42	39.94	42.56	44.88	46.99
DIAMETER (IN)	11.54	11.54	11.91	13.78	15.44	16.96
*** WEIGHTS (LB) ***						
ARRAY	246.4	246.4	248.6	261.2	273.8	286.6
BOOM	17.4	17.4	18.6	24.9	31.2	37.7
CANNISTER	18.3	18.3	19.4	25.4	31.4	37.4
FULL TENSIONER	1.0	1.0	1.1	1.3	1.6	1.9
INTERMEDIATE TENSIONER	.9	.9	.9	1.0	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	166.4	SUPPORT STRUCTURE =	2.7	INTERCONNECT HARNESS =	8.3
BOX COVER =	7.6	BOX HINGE =	.0	COVER LATCH =	1.1
CONTAINER =	17.6	MAST TIP FITTING =	1.7	MID TENSION MECHANISM =	.02
CONT BX CRUISE LATCH =	.0	CONT BX CVR CR LATCH =	.0	CONT BX DEPLOY DEVICE =	.0
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.4		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 8.0 KW   ARRAY WIDTH = 3.50 M

ARRAY LENGTH = 23.04 M   ASPECT RATIO = 6.58   BLANKET AREA = .12500+06 IN=SQ   BLANKET WEIGHT = 166.4 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.029	.029	.029	.038	.047	.056
***** TORSIONAL FREQUENCY HZ *****	.083	.083	.083	.110	.138	.166
***** BENDING FREQUENCY HZ *****	.029	.029	.029	.038	.047	.056
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	108.8	108.8	108.8	112.8	117.0	121.2
ARRAY WEIGHT (LB)	239.4	239.4	239.4	248.1	257.3	266.6
CENTER OF GRAVITY (IN)	389.4	389.4	389.4	382.6	376.0	369.8
BLANKET TENSION (LB)	3.00	3.00	3.00	5.18	8.09	11.65
MOMENT OF INERTIA I1	.5909+08	.5909+08	.5909+08	.6020+08	.6138+08	.6256+08
MOMENT OF INERTIA I2	.3473+06	.3473+06	.3473+06	.3483+06	.3495+06	.3509+06
SPECIFIC POWER (KW/KG)	.074	.074	.074	.071	.068	.066
SPECIFIC WEIGHT (KG/KW)	13.6	13.6	13.6	14.1	14.6	15.1
* BOOM PROPERTIES *						
DIAMETER (IN)	9.04	9.04	9.04	10.37	11.62	12.75
EI (LB-IN-SQ)	.31219+07	.31219+07	.31219+07	.54218+07	.85243+07	.12351+08
ROOT SPRING (LB-IN/RAD)	.5414+05	.5414+05	.5414+05	.8191+05	.1150+06	.1519+06
BUCKLING CAPABILITY RATIO	8.05	8.05	8.05	7.71	7.38	7.06
STRENGTH CAPABILITY RATIO	2.65	2.65	2.65	3.93	5.42	7.02
* CANNISTER PROPERTIES *						
HEIGHT (IN)	34.87	34.87	34.87	37.08	39.13	40.99
DIAMETER (IN)	10.66	10.66	10.66	12.24	13.71	15.04
* WEIGHTS (LB) *						
ARRAY	239.4	239.4	239.4	248.1	257.3	266.6
BOOM	12.8	12.8	12.8	16.8	21.1	25.4
CANNISTER	15.4	15.4	15.4	19.9	24.6	29.3
FULL TENSIONER	1.0	1.0	1.0	1.2	1.5	1.7
INTERMEDIATE TENSIONER	.9	.9	.9	1.0	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	166.4	SUPPORT STRUCTURE =	2.7	INTERCONNECT HARNESS =	8.3
BOX COVER =	7.6	BOX HINGE =	.0	COVER LATCH =	1.1
CONTAINER =	18.4	MAST TIP FITTING =	1.7	MID TENSION MECHANISM =	.02
CONT BX CRUISE LATCH =	.0	CONT BX CVR CR LATCH =	.0	CONT BX DEPLOY DEVICE =	.0
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.1		

ORIGINAL PAGE IS
OF POOR QUALITY

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 8.0 KW   ARRAY WIDTH = 4.00 M

ARRAY LENGTH = 20.16 M   ASPECT RATIO = 5.04   BLANKET AREA = .12500+06 IN-SQ   BLANKET WEIGHT = 166.4 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.031	.031	.031	.038	.047	.056
***** TORSIONAL FREQUENCY HZ *****	.070	.070	.070	.086	.108	.129
***** BENDING FREQUENCY HZ *****	.031	.031	.031	.038	.047	.056
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	106.7	106.7	106.7	109.1	112.3	115.6
ARRAY WEIGHT (LB)	234.8	234.8	234.8	240.1	247.2	254.2
CENTER OF GRAVITY (IN)	342.3	342.3	342.3	338.3	333.2	328.3
BLANKET TENSION (LB)	3.00	3.00	3.00	4.53	7.08	10.20
MOMENT OF INERTIA I1	.4461+08	.4461+08	.4461+08	.4508+08	.4572+08	.4636+08
MOMENT OF INERTIA I2	.4539+06	.4539+06	.4539+06	.4548+06	.4562+06	.4578+06
SPECIFIC POWER (KW/KG)	.075	.075	.075	.073	.071	.069
SPECIFIC WEIGHT (KG/KW)	13.3	13.3	13.3	13.6	14.0	14.4
* BOOM PROPERTIES *						
DIAMETER (IN)	8.44	8.44	8.44	9.37	10.49	11.50
EI (LB-IN-SQ)	.23797+07	.23797+07	.23797+07	.36068+07	.56607+07	.81877+07
ROOT SPRING (LB-IN/RAD)	.4417+05	.4417+05	.4417+05	.6033+05	.8460+05	.1116+06
BUCKLING CAPABILITY RATIO	7.61	7.61	7.61	7.32	6.95	6.61
STRENGTH CAPABILITY RATIO	2.50	2.50	2.50	3.39	4.68	6.09
* CANNISTER PROPERTIES *						
HEIGHT (IN)	31.40	31.40	31.40	32.92	34.77	36.44
DIAMETER (IN)	9.96	9.96	9.96	11.06	12.37	13.57
* WEIGHTS (LB) *						
ARRAY	234.8	234.8	234.8	240.1	247.2	254.2
BOOM	9.8	9.8	9.8	12.0	15.0	18.1
CANNISTER	13.3	13.3	13.3	16.2	20.0	23.8
FULL TENSIONER	1.0	1.0	1.0	1.2	1.4	1.6
INTERMEDIATE TENSIONER	.9	.9	.9	.9	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	166.4	SUPPORT STRUCTURE =	2.7	INTERCONNECT HARNESS =	8.3
BOX COVER =	7.6	BOX HINGE =	.0	COVER LATCH =	1.1
CONTAINER =	19.2	MAST TIP FITTING =	1.7	MID TENSION MECHANISM =	.02
CONT BX CRUISE LATCH =	.0	CONT BX CVR CR LATCH =	.0	CONT BX DEPLOY DEVICE =	.0
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	2.8		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 8.0 KW   ARRAY WIDTH = 4.50 M

ARRAY LENGTH = 17.92 M   ASPECT RATIO = 3.98   BLANKET AREA = .12500+06 IN*SQ   BLANKET WEIGHT = 166.4 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.033	.033	.033	.038	.047	.056
***** TORSIONAL FREQUENCY HZ *****	.061	.061	.061	.070	.088	.106
***** BENDING FREQUENCY HZ *****	.033	.033	.033	.038	.047	.056
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	108.8	108.8	108.8	110.2	112.8	115.4
ARRAY WEIGHT (LB)	239.4	239.4	239.4	242.5	248.1	253.8
CENTER OF GRAVITY (IN)	297.9	297.9	297.9	295.8	292.1	288.5
BLANKET TENSION (LB)	3.00	3.00	3.00	4.03	6.29	9.06
MOMENT OF INERTIA I1	.3533+08	.3533+08	.3533+08	.3553+08	.3591+08	.3628+08
MOMENT OF INERTIA I2	.6086+06	.6086+06	.6086+06	.6093+06	.6110+06	.6129+06
SPECIFIC POWER (KW/KG)	.074	.074	.074	.073	.071	.069
SPECIFIC WEIGHT (KG/KW)	13.6	13.6	13.6	13.8	14.1	14.4
* BOOM PROPERTIES *						
DIAMETER (IN)	7.96	7.96	7.96	8.58	9.60	10.52
EI (LB*IN*SQ)	.18812+07	.18812+07	.18812+07	.25307+07	.39673+07	.57318+07
ROOT SPRING (LB*IN/RAD)	.3703+05	.3703+05	.3703+05	.4626+05	.6480+05	.8540+05
BUCKLING CAPABILITY RATIO	7.23	7.23	7.23	6.99	6.59	6.23
STRENGTH CAPABILITY RATIO	2.37	2.37	2.37	2.94	4.08	5.32
* CANNISTER PROPERTIES *						
HEIGHT (IN)	28.66	28.66	28.66	29.67	31.35	32.88
DIAMETER (IN)	9.40	9.40	9.40	10.12	11.32	12.41
* WEIGHTS (LB) *						
ARRAY	239.4	239.4	239.4	242.5	248.1	253.8
BOOM	7.7	7.7	7.7	8.9	11.2	13.5
CANNISTER	11.8	11.8	11.8	13.5	16.7	19.8
FULL TENSIONER	1.0	1.0	1.0	1.1	1.3	1.5
INTERMEDIATE TENSIONER	.9	.9	.9	.9	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	166.4	SUPPORT STRUCTURE =	2.7	INTERCONNECT HARNESS =	8.3
BOX COVER =	7.6	BOX HINGE =	.0	COVER LATCH =	2.7
CONTAINER =	21.3	MAST TIP FITTING =	2.2	MID TENSION MECHANISM =	.02
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	.9
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	2.7		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 8.0 KW   ARRAY WIDTH = 5.00 M

ARRAY LENGTH = 16.13 M   ASPECT RATIO = 3.23   BLANKET AREA = .12500+06 IN=SQ   BLANKET WEIGHT = 166.4 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.034	.034	.034	.038	.047	.056
***** TORSIONAL FREQUENCY HZ *****	.054	.054	.054	.059	.074	.089
***** BENDING FREQUENCY HZ *****	.034	.034	.034	.038	.047	.056
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	108.0	108.0	108.0	108.8	110.9	113.0
ARRAY WEIGHT (LB)	237.7	237.7	237.7	239.4	244.0	248.6
CENTER OF GRAVITY (IN)	268.2	268.2	268.2	267.1	264.1	261.2
BLANKET TENSION (LB)	3.00	3.00	3.00	3.63	5.66	8.16
MOMENT OF INERTIA I1	.2842+08	.2842+08	.2842+08	.2850+08	.2873+08	.2897+08
MOMENT OF INERTIA I2	.7477+06	.7477+06	.7477+06	.7482+06	.7501+06	.7523+06
SPECIFIC POWER (KW/KG)	.074	.074	.074	.074	.072	.071
SPECIFIC WEIGHT (KG/KW)	13.5	13.5	13.5	13.6	13.9	14.1
* BOOM PROPERTIES *						
DIAMETER (IN)	7.55	7.55	7.55	7.92	8.86	9.71
EI (LB=IN=SQ)	.15205+07	.15205+07	.15205+07	.18393+07	.28812+07	.41595+07
ROOT SPRING (LB=IN/RAD)	.3157+05	.3157+05	.3157+05	.3641+05	.5098+05	.6714+05
BUCKLING CAPABILITY RATIO	6.83	6.83	6.83	6.67	6.26	5.89
STRENGTH CAPABILITY RATIO	2.26	2.26	2.26	2.60	3.61	4.71
* CANNISTER PROPERTIES *						
HEIGHT (IN)	26.43	26.43	26.43	27.03	28.59	29.99
DIAMETER (IN)	8.91	8.91	8.91	9.34	10.45	11.46
* WEIGHTS (LB) *						
ARRAY	237.7	237.7	237.7	239.4	244.0	248.6
BOOM	6.2	6.2	6.2	6.9	8.6	10.3
CANNISTER	10.5	10.5	10.5	11.5	14.2	16.8
FULL TENSIONER	1.0	1.0	1.0	1.1	1.3	1.5
INTERMEDIATE TENSIONER	.9	.9	.9	.9	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	166.4	SUPPORT STRUCTURE =	2.7	INTERCONNECT HARNESS =	8.3
BOX COVER =	7.6	BOX HINGE =	.0	COVER LATCH =	2.7
CONTAINER =	22.5	MAST TIP FITTING =	2.2	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	.9
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	2.5		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 10.0 KW ARRAY WIDTH = 3.00 M

ARRAY LENGTH = 33.60 M ASPECT RATIO = 11.20 BLANKET AREA = .15625+06 IN-SQ BLANKET WEIGHT = 208.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.022	.022	.029	.038	.047	.056
***** TORSIONAL FREQUENCY HZ *****	.103	.103	.138	.185	.233	.282
***** BENDING FREQUENCY HZ *****	.022	.022	.029	.038	.047	.056
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	141.3	141.3	148.9	159.0	169.3	179.8
ARRAY WEIGHT (LB)	310.9	310.9	327.5	349.9	372.6	395.6
CENTER OF GRAVITY (IN)	568.7	568.7	558.0	545.0	533.5	523.1
BLANKET TENSION (LB)	3.00	3.00	5.31	9.44	14.75	21.24
MOMENT OF INERTIA I1	.1630+09	.1630+09	.1684+09	.1757+09	.1832+09	.1907+09
MOMENT OF INERTIA I2	.3141+06	.3141+06	.3149+06	.3162+06	.3176+06	.3194+06
SPECIFIC POWER (KW/KG)	.071	.071	.067	.063	.059	.056
SPECIFIC WEIGHT (KG/KW)	14.1	14.1	14.9	15.9	16.9	18.0
* BOOM PROPERTIES *						
DIAMETER (IN)	10.94	10.94	12.66	14.67	16.46	18.09
EI (LB-IN-SQ)	.67127+07	.67127+07	.12010+08	.21659+08	.34327+08	.50141+08
ROOT SPRING (LB-IN/RAD)	.9614+05	.9614+05	.1487+06	.2314+06	.3269+06	.4344+06
BUCKLING CAPABILITY RATIO	9.01	9.01	8.86	8.65	8.43	8.21
STRENGTH CAPABILITY RATIO	2.48	2.48	3.71	5.53	7.50	9.57
* CANNISTER PROPERTIES *						
HEIGHT (IN)	47.16	47.16	49.99	53.31	56.26	58.96
DIAMETER (IN)	12.91	12.91	14.94	17.31	19.42	21.35
* WEIGHTS (LB) *						
ARRAY	310.9	310.9	327.5	349.9	372.6	395.6
BOOM	27.3	27.3	36.5	49.0	61.7	74.6
CANNISTER	23.4	23.4	30.5	40.0	49.6	59.2
FULL TENSIONER	1.0	1.0	1.2	1.6	2.0	2.5
INTERMEDIATE TENSIONER	.9	.9	1.0	1.0	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	208.0	SUPPORT STRUCTURE =	2.9	INTERCONNECT HARNESS =	10.3
BOX COVER =	9.5	BOX HINGE =	.0	COVER LATCH =	1.1
CONTAINER =	20.8	MAST TIP FITTING =	1.8	MID TENSION MECHANISM =	.02
CONT BX CRUISE LATCH =	.0	CONT BX CVR CR LATCH =	.0	CONT BX DEPLOY DEVICE =	.0
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.9		

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 10.0 KW   ARRAY WIDTH = 3.50 M

ARRAY LENGTH = 28.80 M   ASPECT RATIO = 8.23   BLANKET AREA = .15625+06 IN=SQ   BLANKET WEIGHT = 208.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.023	.023	.029	.038	.047	.056
***** TORSIONAL FREQUENCY HZ *****	.082	.082	.102	.136	.171	.207
***** BENDING FREQUENCY HZ *****	.023	.023	.029	.038	.047	.056
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	136.5	136.5	140.6	148.0	155.4	162.8
ARRAY WEIGHT (LB)	300.4	300.4	309.4	325.5	341.8	358.2
CENTER OF GRAVITY (IN)	491.0	491.0	484.9	474.9	465.7	457.2
BLANKET TENSION (LB)	3.00	3.00	4.55	8.09	12.65	18.21
MOMENT OF INERTIA I1	.1166+09	.1166+09	.1187+09	.1223+09	.1259+09	.1296+09
MOMENT OF INERTIA I2	.4271+06	.4271+06	.4277+06	.4293+06	.4310+06	.4331+06
SPECIFIC POWER (KW/KG)	.073	.073	.071	.068	.064	.061
SPECIFIC WEIGHT (KG/KW)	13.7	13.7	14.1	14.8	15.5	16.3
* BOOM PROPERTIES *						
DIAMETER (IN)	10.11	10.11	11.24	13.01	14.58	16.01
EI (LB=IN=SQ)	.48900+07	.48900+07	.74608+07	.13393+08	.21130+08	.30724+08
ROOT SPRING (LB=IN/RAD)	.7581+05	.7581+05	.1041+06	.1614+06	.2272+06	.3008+06
BUCKLING CAPABILITY RATIO	8.63	8.63	8.46	8.17	7.88	7.59
STRENGTH CAPABILITY RATIO	2.34	2.34	3.16	4.76	6.51	8.37
* CANNISTER PROPERTIES *						
HEIGHT (IN)	41.63	41.63	43.49	46.41	49.00	51.36
DIAMETER (IN)	11.93	11.93	13.26	15.35	17.20	18.89
* WEIGHTS (LB) *						
ARRAY	300.4	300.4	309.4	325.5	341.8	358.2
BOOM	20.0	20.0	24.7	33.0	41.5	50.1
CANNISTER	19.7	19.7	23.9	31.3	38.7	46.2
FULL TENSIONER	1.0	1.0	1.2	1.5	1.8	2.2
INTERMEDIATE TENSIONER	.9	.9	.9	1.0	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	208.0	SUPPORT STRUCTURE =	2.9	INTERCONNECT HARNESS =	10.3
BOX COVER =	9.5	BOX HINGE =	.0	COVER LATCH =	1.2
CONTAINER =	21.6	MAST TIP FITTING =	1.8	MID TENSION MECHANISM =	.02
CONT BX CRUISE LATCH =	.0	CONT BX CVR CR LATCH =	.0	CONT BX DEPLOY DEVICE =	.0
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.5		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 10.0 KW ARRAY WIDTH = 4.00 M

ARRAY LENGTH = 25.20 M ASPECT RATIO = 6.30 BLANKET AREA = .15625+06 IN-SQ BLANKET WEIGHT = 208.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.025	.025	.029	.038	.047	.056
***** TORSIONAL FREQUENCY HZ *****	.068	.068	.079	.106	.132	.159
***** BENDING FREQUENCY HZ *****	.025	.025	.029	.038	.047	.056
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	133.4	133.4	135.6	141.2	146.7	152.4
ARRAY WEIGHT (LB)	293.5	293.5	298.3	310.5	322.8	335.2
CENTER OF GRAVITY (IN)	431.9	431.9	428.6	420.8	413.4	406.5
BLANKET TENSION (LB)	3.00	3.00	3.98	7.08	11.06	15.93
MOMENT OF INERTIA I1	.8776+08	.8776+08	.8853+08	.9048+08	.9245+08	.9444+08
MOMENT OF INERTIA I2	.5577+06	.5577+06	.5583+06	.5601+06	.5621+06	.5645+06
SPECIFIC POWER (KW/KG)	.075	.075	.074	.071	.068	.066
SPECIFIC WEIGHT (KG/KW)	13.3	13.3	13.6	14.1	14.7	15.2
* BOOM PROPERTIES *						
DIAMETER (IN)	9.44	9.44	10.14	11.73	13.14	14.42
EI (LB-IN-SQ)	.37233+07	.37233+07	.49571+07	.88741+07	.13962+08	.20246+08
ROOT SPRING (LB-IN/RAD)	.6179+05	.6179+05	.7659+05	.1185+06	.1665+06	.2200+06
BUCKLING CAPABILITY RATIO	8.27	8.27	8.12	7.77	7.43	7.10
STRENGTH CAPABILITY RATIO	2.22	2.22	2.73	4.14	5.69	7.36
* CANNISTER PROPERTIES *						
HEIGHT (IN)	37.41	37.41	38.57	41.19	43.51	45.62
DIAMETER (IN)	11.14	11.14	11.97	13.85	15.51	17.02
* WEIGHTS (LB) *						
ARRAY	293.5	293.5	298.3	310.5	322.8	335.2
BOOM	15.2	15.2	17.6	23.5	29.5	35.6
CANNISTER	17.0	17.0	19.4	25.4	31.4	37.4
FULL TENSIONER	1.0	1.0	1.1	1.4	1.7	2.1
INTERMEDIATE TENSIONER	.9	.9	.9	1.0	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	208.0	SUPPORT STRUCTURE =	2.9	INTERCONNECT HARNESS =	10.3
BOX COVER =	9.5	BOX HINGE =	.0	COVER LATCH =	1.2
CONTAINER =	27.4	MAST TIP FITTING =	1.8	MID TENSION MECHANISM =	.02
CONT BX CRUISE LATCH =	.0	CONT BX CVR CR LATCH =	.0	CONT BX DEPLOY DEVICE =	.0
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.2		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 10.0 KW ARRAY WIDTH = 4.50 M

ARRAY LENGTH = 22.40 M ASPECT RATIO = 4.98 BLANKET AREA = .15625+06 IN=SQ BLANKET WEIGHT = 208.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.026	.026	.028	.038	.047	.056
***** TORSIONAL FREQUENCY HZ *****	.059	.059	.064	.085	.107	.128
***** BENDING FREQUENCY HZ *****	.026	.026	.028	.038	.047	.056
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	134.7	134.7	135.7	140.1	144.5	149.0
ARRAY WEIGHT (LB)	296.3	296.3	298.6	308.3	318.0	327.8
CENTER OF GRAVITY (IN)	378.0	378.0	376.6	370.7	365.2	359.9
BLANKET TENSION (LB)	3.00	3.00	3.54	6.29	9.84	14.16
MOMENT OF INERTIA I1	.6916+08	.6916+08	.6943+08	.7058+08	.7173+08	.7289+08
MOMENT OF INERTIA I2	.7403+06	.7403+06	.7407+06	.7427+06	.7451+06	.7478+06
SPECIFIC POWER (KW/KG)	.074	.074	.074	.071	.069	.067
SPECIFIC WEIGHT (KG/KW)	13.5	13.5	13.6	14.0	14.5	14.9
* BOOM PROPERTIES *						
DIAMETER (IN)	8.90	8.90	9.28	10.73	12.01	13.18
EI (LB-IN-SQ)	.29391+07	.29391+07	.34730+07	.62062+07	.97474+07	.14109+08
ROOT SPRING (LB-IN/RAD)	.5175+05	.5175+05	.5865+05	.9065+05	.1272+06	.1678+06
BUCKLING CAPABILITY RATIO	7.94	7.94	7.84	7.44	7.06	6.70
STRENGTH CAPABILITY RATIO	2.11	2.11	2.38	3.62	4.99	6.49
* CANNISTER PROPERTIES *						
HEIGHT (IN)	34.09	34.09	34.72	37.11	39.22	41.14
DIAMETER (IN)	10.50	10.50	10.95	12.66	14.18	15.55
* WEIGHTS (LB) *						
ARRAY	296.3	296.3	298.6	308.3	318.0	327.8
BOOM	12.0	12.0	13.1	17.5	21.9	26.4
CANNISTER	15.0	15.0	16.1	21.1	26.1	31.1
FULL TENSIONER	1.0	1.0	1.1	1.3	1.6	1.9
INTERMEDIATE TENSIONER	.9	.9	.9	1.0	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	208.0	SUPPORT STRUCTURE =	2.9	INTERCONNECT HARNESS =	10.3
BOX COVER =	9.5	BOX HINGE =	.0	COVER LATCH =	2.9
CONTAINER =	24.1	MAST TIP FITTING =	2.3	MID TENSION MECHANISM =	.02
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	1.2
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.0		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 10.0 KW ARRAY WIDTH = 5.00 M

ARRAY LENGTH = 20.16 M ASPECT RATIO = 4.03 BLANKET AREA = .15625+06 IN=SQ BLANKET WEIGHT = 208.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.028	.028	.028	.038	.047	.056
***** TORSIONAL FREQUENCY HZ *****	.052	.052	.053	.071	.089	.107
***** BENDING FREQUENCY HZ *****	.028	.028	.028	.038	.047	.056
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	133.4	133.4	133.7	137.2	140.8	144.4
ARRAY WEIGHT (LB)	293.4	293.4	294.1	301.9	309.8	317.7
CENTER OF GRAVITY (IN)	340.6	340.6	340.2	335.5	331.0	326.7
BLANKET TENSION (LB)	3.00	3.00	3.19	5.66	8.85	12.75
MOMENT OF INERTIA I1	.5554+08	.5554+08	.5560+08	.5631+08	.5703+08	.5774+08
MOMENT OF INERTIA I2	.9096+06	.9096+06	.9097+06	.9120+06	.9147+06	.9177+06
SPECIFIC POWER (KW/KG)	.075	.075	.075	.073	.071	.069
SPECIFIC WEIGHT (KG/KW)	13.3	13.3	13.4	13.7	14.1	14.4
* BOOM PROPERTIES *						
DIAMETER (IN)	8.44	8.44	8.57	9.90	11.08	12.15
EI (LB-IN=SQ)	.23742+07	.23742+07	.25228+07	.45028+07	.70636+07	.10212+08
ROOT SPRING (LB=IN/RAD)	.4409+05	.4409+05	.4615+05	.7126+05	.9988+05	.1317+06
BUCKLING CAPABILITY RATIO	7.60	7.60	7.56	7.12	6.72	6.35
STRENGTH CAPABILITY RATIO	2.01	2.01	2.10	3.21	4.44	5.78
* CANNISTER PROPERTIES *						
HEIGHT (IN)	31.39	31.39	31.60	33.80	35.75	37.52
DIAMETER (IN)	9.96	9.96	10.11	11.69	13.08	14.34
* WEIGHTS (LB) *						
ARRAY	293.4	293.4	294.1	301.9	309.8	317.7
BOOM	9.7	9.7	10.0	13.4	16.8	20.2
CANNISTER	13.3	13.3	13.7	17.9	22.2	26.4
FULL TENSIONER	1.0	1.0	1.0	1.3	1.5	1.8
INTERMEDIATE TENSIONER	.9	.9	.9	1.0	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	208.0	SUPPORT STRUCTURE =	2.9	INTERCONNECT HARNESS =	10.3
BOX COVER =	9.5	BOX HINGE =	.0	COVER LATCH =	2.9
CONTAINER =	25.3	MAST TIP FITTING =	2.3	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	1.2
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	2.8		

ARRAY TYPE LMSC FOLDOUT　　POWER/WING = 10.0 KW　　ARRAY WIDTH = 5.50 M

ARRAY LENGTH = 18.33 M　　ASPECT RATIO = 3.33　　BLANKET AREA = .15625+06 IN*SQ　　BLANKET WEIGHT = 208.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.029	.029	.029	.038	.047	.056
***** TORSIONAL FREQUENCY HZ *****	.046	.046	.046	.061	.076	.091
***** BENDING FREQUENCY HZ *****	.029	.029	.029	.038	.047	.056
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	132.4	132.4	132.4	135.2	138.2	141.2
ARRAY WEIGHT (LB)	291.4	291.4	291.4	297.5	304.1	310.7
CENTER OF GRAVITY (IN)	309.7	309.7	309.7	306.1	302.4	298.9
BLANKET TENSION (LB)	3.00	3.00	3.00	5.15	8.05	11.59
MOMENT OF INERTIA I1	.4561+08	.4561+08	.4561+08	.4604+08	.4651+08	.4697+08
MOMENT OF INERTIA I2	.1098+07	.1098+07	.1098+07	.1100+07	.1103+07	.1106+07
SPECIFIC POWER (KW/KG)	.076	.076	.076	.074	.072	.071
SPECIFIC WEIGHT (KG/KW)	13.2	13.2	13.2	13.5	13.8	14.1
* BOOM PROPERTIES *						
DIAMETER (IN)	8.04	8.04	8.04	9.21	10.31	11.30
EI (LB*IN*SQ)	.19583+07	.19583+07	.19583+07	.33717+07	.52847+07	.76339+07
ROOT SPRING (LB*IN/RAD)	.3816+05	.3816+05	.3816+05	.5736+05	.8035+05	.1059+06
BUCKLING CAPABILITY RATIO	7.27	7.27	7.27	6.83	6.41	6.03
STRENGTH CAPABILITY RATIO	1.93	1.93	1.93	2.87	3.98	5.20
* CANNISTER PROPERTIES *						
HEIGHT (IN)	29.15	29.15	29.15	31.08	32.88	34.52
DIAMETER (IN)	9.49	9.49	9.49	10.87	12.16	13.34
* WEIGHTS (LB) *						
ARRAY	291.4	291.4	291.4	297.5	304.1	310.7
BOOM	8.0	8.0	8.0	10.6	13.2	15.9
CANNISTER	12.0	12.0	12.0	15.5	19.1	22.7
FULL TENSIONER	1.0	1.0	1.0	1.2	1.5	1.7
INTERMEDIATE TENSIONER	.9	.9	.9	1.0	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	208.0	SUPPORT STRUCTURE =	2.9	INTERCONNECT HARNESS =	10.3
BOX COVER =	9.5	BOX HINGE =	.1	COVER LATCH =	2.9
CONTAINER =	26.4	MAST TIP FITTING =	2.3	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	1.2
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	2.7		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 10.0 KW ARRAY WIDTH = 6.00 M

ARRAY LENGTH = 16.80 M ASPECT RATIO = 2.80 BLANKET AREA = .15625+06 IN-SQ BLANKET WEIGHT = 208.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.030	.030	.030	.038	.047	.056
***** TORSIONAL FREQUENCY HZ *****	.043	.043	.043	.053	.067	.080
***** BENDING FREQUENCY HZ *****	.030	.030	.030	.038	.047	.056
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	131.8	131.8	131.8	133.9	136.4	138.9
ARRAY WEIGHT (LB)	290.0	290.0	290.0	294.5	300.1	305.7
CENTER OF GRAVITY (IN)	283.8	283.8	283.8	281.3	278.2	275.2
BLANKET TENSION (LB)	3.00	3.00	3.00	4.72	7.38	10.62
MOMENT OF INERTIA I1	.3813+08	.3813+08	.3813+08	.3839+08	.3870+08	.3901+08
MOMENT OF INERTIA I2	.1305+07	.1305+07	.1305+07	.1307+07	.1311+07	.1314+07
SPECIFIC POWER (KW/KG)	.076	.076	.076	.075	.073	.072
SPECIFIC WEIGHT (KG/KW)	13.2	13.2	13.2	13.4	13.6	13.9
* BOOM PROPERTIES *						
DIAMETER (IN)	7.70	7.70	7.70	8.63	9.65	10.58
EI (LB-IN-SQ)	.16430+07	.16430+07	.16430+07	.25907+07	.40582+07	.58586+07
ROOT SPRING (LB-IN/RAD)	.3345+05	.3345+05	.3345+05	.4708+05	.6591+05	.8681+05
BUCKLING CAPABILITY RATIO	6.96	6.96	6.96	6.57	6.13	5.75
STRENGTH CAPABILITY RATIO	1.85	1.85	1.85	2.59	3.60	4.70
* CANNISTER PROPERTIES *						
HEIGHT (IN)	27.25	27.25	27.25	28.78	30.47	32.01
DIAMETER (IN)	9.08	9.08	9.08	10.18	11.39	12.48
* WEIGHTS (LB) *						
ARRAY	290.0	290.0	290.0	294.5	300.1	305.7
BOOM	6.8	6.8	6.8	8.5	10.6	12.7
CANNISTER	10.9	10.9	10.9	13.5	16.7	19.9
FULL TENSIONER	1.0	1.0	1.0	1.2	1.4	1.7
INTERMEDIATE TENSIONER	.9	.9	.9	1.0	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	208.0	SUPPORT STRUCTURE =	2.9	INTERCONNECT HARNESS =	10.3
BOX COVER =	9.5	BOX HINGE =	.1	COVER LATCH =	2.8
CONTAINER =	27.5	MAST TIP FITTING =	2.3	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	1.2
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	2.6		

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 12.5 KW   ARRAY WIDTH = 3.00 M

ARRAY LENGTH = 42.00 M   ASPECT RATIO = 14.00   BLANKET AREA = .19531+06 IN=SQ   BLANKET WEIGHT = 260.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.017	.019	.028	.038	.047	.055
***** TORSIONAL FREQUENCY HZ *****	.103	.115	.174	.234	.296	.359
***** BENDING FREQUENCY HZ *****	.017	.019	.028	.038	.047	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	179.6	183.1	201.4	220.0	239.0	258.4
ARRAY WEIGHT (LB)	395.0	402.8	443.0	483.9	525.7	568.4
CENTER OF GRAVITY (IN)	716.0	711.7	691.7	674.9	660.3	647.6
BLANKET TENSION (LB)	3.00	3.69	8.30	14.75	23.05	33.19
MOMENT OF INERTIA I1	.3253+09	.3296+09	.3521+09	.3750+09	.3984+09	.4224+09
MOMENT OF INERTIA I2	.3878+06	.3880+06	.3895+06	.3912+06	.3935+06	.3964+06
SPECIFIC POWER (KW/KG)	.070	.068	.062	.057	.052	.048
SPECIFIC WEIGHT (KG/KW)	14.4	14.6	16.1	17.6	19.1	20.7
* BOOM PROPERTIES *						
DIAMETER (IN)	12.25	12.92	15.91	18.47	20.77	22.88
EI (LB-IN-SQ)	.10554+08	.13032+08	.29984+08	.54506+08	.87084+08	.12822+09
ROOT SPRING (LB-IN/RAD)	.1350+06	.1581+06	.2954+06	.4624+06	.6572+06	.8784+06
BUCKLING CAPABILITY RATIO	9.43	9.41	9.31	9.21	9.08	8.93
STRENGTH CAPABILITY RATIO	2.18	2.51	4.39	6.45	8.63	10.88
* CANNISTER PROPERTIES *						
HEIGHT (IN)	56.60	57.69	62.63	66.86	70.65	74.13
DIAMETER (IN)	14.46	15.24	18.77	21.80	24.51	27.00
* WEIGHTS (LB) *						
ARRAY	395.0	402.8	443.0	483.9	525.7	568.4
BOOM	42.8	47.5	72.1	97.2	122.9	149.1
CANNISTER	29.9	32.9	48.1	63.4	78.9	94.6
FULL TENSIONER	1.0	1.1	1.5	2.0	2.6	3.3
INTERMEDIATE TENSIONER	.9	.9	1.0	1.0	1.0	1.1

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	260.0	SUPPORT STRUCTURE =	3.1	INTERCONNECT HARNESS =	12.9
BOX COVER =	11.8	BOX HINGE =	.0	COVER LATCH =	1.3
CONTAINER =	24.8	MAST TIP FITTING =	1.9	MID TENSION MECHANISM =	.02
CONT BX CRUISE LATCH =	.0	CONT BX CVR CR LATCH =	.0	CONT BX DEPLOY DEVICE =	.0
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.6		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 12.5 KW   ARRAY WIDTH = 3.50 M

ARRAY LENGTH = 36.00 M   ASPECT RATIO = 10.29   BLANKET AREA = .19531+06 IN=SQ   BLANKET WEIGHT = 260.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.019	.019	.028	.038	.047	.055
***** TORSIONAL FREQUENCY HZ *****	.082	.084	.127	.171	.215	.260
***** BENDING FREQUENCY HZ *****	.019	.019	.028	.038	.047	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	172.3	173.0	186.0	199.1	212.5	226.0
ARRAY WEIGHT (LB)	379.1	380.6	409.1	438.1	467.4	497.2
CENTER OF GRAVITY (IN)	618.3	617.5	601.8	588.1	575.9	564.9
BLANKET TENSION (LB)	3.00	3.16	7.11	12.65	19.76	28.45
MOMENT OF INERTIA I1	.2313+09	.2319+09	.2429+09	.2540+09	.2654+09	.2769+09
MOMENT OF INERTIA I2	.5268+06	.5269+06	.5286+06	.5307+06	.5334+06	.5367+06
SPECIFIC POWER (KW/KG)	.073	.072	.067	.063	.059	.055
SPECIFIC WEIGHT (KG/KW)	13.8	13.8	14.9	15.9	17.0	18.1
* BOOM PROPERTIES *						
DIAMETER (IN)	11.32	11.47	14.10	16.34	18.34	20.16
EI (LB-IN=SQ)	.76720+07	.80907+07	.18482+08	.33360+08	.52921+08	.77370+08
ROOT SPRING (LB-IN/RAD)	.1063+06	.1106+06	.2055+06	.3200+06	.4523+06	.6014+06
BUCKLING CAPABILITY RATIO	9.10	9.09	8.87	8.66	8.43	8.19
STRENGTH CAPABILITY RATIO	2.07	2.15	3.80	5.66	7.66	9.76
* CANNISTER PROPERTIES *						
HEIGHT (IN)	49.85	50.10	54.44	58.14	61.44	64.45
DIAMETER (IN)	13.35	13.53	16.63	19.28	21.64	23.79
* WEIGHTS (LB) *						
ARRAY	379.1	380.6	409.1	438.1	467.4	497.2
BOOM	31.3	32.1	48.5	65.2	82.1	99.3
CANNISTER	25.2	25.8	37.6	49.4	61.2	73.2
FULL TENSIONER	1.0	1.0	1.4	1.8	2.3	3.0
INTERMEDIATE TENSIONER	.9	.9	1.0	1.0	1.0	1.1

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	260.0	SUPPORT STRUCTURE =	3.1	INTERCONNECT HARNESS =	12.9
BOX COVER =	11.8	BOX HINGE =	.0	COVER LATCH =	1.3
CONTAINER =	25.6	MAST TIP FITTING =	1.9	MID TENSION MECHANISM =	.02
CONT BX CRUISE LATCH =	.0	CONT BX CVR CR LATCH =	.0	CONT BX DEPLOY DEVICE =	.0
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.1		

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE LMSC FOLDOUT POWER/WING = 12.5 KW ARRAY WIDTH = 4.00 M

ARRAY LENGTH = 31.50 M ASPECT RATIO = 7.88 BLANKET AREA = .19531+06 IN-SQ BLANKET WEIGHT = 260.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.020	.020	.028	.038	.047	.056
***** TORSIONAL FREQUENCY HZ *****	.068	.068	.098	.131	.165	.199
***** BENDING FREQUENCY HZ *****	.020	.020	.028	.038	.047	.056
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	167.6	167.6	176.5	186.4	196.3	206.4
ARRAY WEIGHT (LB)	368.6	368.6	388.4	410.0	431.9	454.1
CENTER OF GRAVITY (IN)	544.1	544.1	532.8	521.8	511.6	502.3
BLANKET TENSION (LB)	3.00	3.00	6.22	11.06	17.29	24.89
MOMENT OF INERTIA I1	.1733+09	.1733+09	.1788+09	.1848+09	.1909+09	.1971+09
MOMENT OF INERTIA I2	.6875+06	.6875+06	.6894+06	.6919+06	.6950+06	.6987+06
SPECIFIC POWER (KW/KG)	.075	.075	.071	.067	.064	.061
SPECIFIC WEIGHT (KG/KW)	13.4	13.4	14.1	14.9	15.7	16.5
* BOOM PROPERTIES *						
DIAMETER (IN)	10.57	10.57	12.71	14.72	16.50	18.13
EI (LB-IN-SQ)	.58334+07	.58334+07	.12223+08	.21967+08	.34699+08	.50512+08
ROOT SPRING (LB-IN/RAD)	.8653+05	.8653+05	.1507+06	.2339+06	.3296+06	.4368+06
BUCKLING CAPABILITY RATIO	8.79	8.79	8.52	8.23	7.94	7.64
STRENGTH CAPABILITY RATIO	1.97	1.97	3.32	4.98	6.80	8.73
* CANNISTER PROPERTIES *						
HEIGHT (IN)	44.72	44.72	48.26	51.57	54.51	57.19
DIAMETER (IN)	12.47	12.47	15.00	17.37	19.47	21.39
* WEIGHTS (LB) *						
ARRAY	368.6	368.6	388.4	410.0	431.9	454.1
BOOM	23.9	23.9	34.5	46.3	58.2	70.2
CANNISTER	21.7	21.7	30.4	39.9	49.4	59.0
FULL TENSIONER	1.0	1.0	1.3	1.7	2.2	2.7
INTERMEDIATE TENSIONER	.9	.9	1.0	1.0	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	260.0	SUPPORT STRUCTURE =	3.1	INTERCONNECT HARNESS =	12.9
BOX COVER =	11.8	BOX HINGE =	.0	COVER LATCH =	1.3
CONTAINER =	26.3	MAST TIP FITTING =	1.9	MID TENSION MECHANISM =	.02
CONT BX CRUISE LATCH =	.0	CONT BX CVR CR LATCH =	.0	CONT BX DEPLOY DEVICE =	.0
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.8		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 12.5 KW   ARRAY WIDTH = 4.50 M

ARRAY LENGTH = 28.00 M   ASPECT RATIO = 6.22   BLANKET AREA = .19531+06 IN-SQ   BLANKET WEIGHT = 260.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.021	.021	.028	.038	.047	.056
***** TORSIONAL FREQUENCY HZ *****	.057	.057	.078	.105	.131	.158
***** BENDING FREQUENCY HZ *****	.021	.021	.028	.038	.047	.056
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	167.7	167.7	173.8	181.5	189.2	197.1
ARRAY WEIGHT (LB)	369.0	369.0	382.4	399.3	416.3	433.6
CENTER OF GRAVITY (IN)	478.2	478.2	471.0	462.4	454.5	447.1
BLANKET TENSION (LB)	3.00	3.00	5.53	9.84	15.37	22.13
MOMENT OF INERTIA I1	.1359+09	.1359+09	.1387+09	.1422+09	.1458+09	.1493+09
MOMENT OF INERTIA I2	.9052+06	.9052+06	.9070+06	.9100+06	.9134+06	.9176+06
SPECIFIC POWER (KW/KG)	.075	.075	.072	.069	.066	.063
SPECIFIC WEIGHT (KG/KW)	13.4	13.4	13.9	14.5	15.1	15.8
* BOOM PROPERTIES *						
DIAMETER (IN)	9.96	9.96	11.62	13.44	15.06	16.53
EI (LB-IN-SQ)	.45978+07	.45978+07	.85330+07	.15293+08	.24089+08	.34970+08
ROOT SPRING (LB-IN/RAD)	.7238+05	.7238+05	.1151+06	.1783+06	.2507+06	.3315+06
BUCKLING CAPABILITY RATIO	8.52	8.52	8.24	7.89	7.54	7.20
STRENGTH CAPABILITY RATIO	1.87	1.87	2.91	4.40	6.04	7.80
* CANNISTER PROPERTIES *						
HEIGHT (IN)	40.68	40.68	43.43	46.44	49.11	51.53
DIAMETER (IN)	11.75	11.75	13.71	15.87	17.77	19.51
* WEIGHTS (LB) *						
ARRAY	369.0	369.0	382.4	399.3	416.3	433.6
BOOM	18.8	18.8	25.6	34.3	43.1	51.9
CANNISTER	19.0	19.0	25.3	33.2	41.0	48.9
FULL TENSIONER	1.0	1.0	1.2	1.6	2.0	2.5
INTERMEDIATE TENSIONER	.9	.9	1.0	1.0	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	260.0	SUPPORT STRUCTURE =	3.1	INTERCONNECT HARNESS =	12.9
BOX COVER =	11.8	BOX HINGE =	.0	COVER LATCH =	3.3
CONTAINER =	27.6	MAST TIP FITTING =	2.3	MID TENSION MECHANISM =	.02
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	1.5
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.5		

ORIGINAL PAGE IS
OF POOR QUALITY

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 12.5 KW   ARRAY WIDTH = 5.00 M

ARRAY LENGTH = 25.20 M   ASPECT RATIO = 5.04   BLANKET AREA = .19531+06 IN*SQ   BLANKET WEIGHT = 260.0 LB

FREQUENCY DEPENDENT PARAMETERS

/***** MINIMUM FREQUENCY HZ *****	.022	.022	.028	.038	.047	.056
***** TORSIONAL FREQUENCY HZ *****	.050	.050	.064	.086	.108	.130
***** BENDING FREQUENCY HZ *****	.022	.022	.028	.038	.047	.056
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	165.6	165.6	169.7	175.9	182.1	188.4
ARRAY WEIGHT (LB)	364.2	364.2	373.4	387.0	400.7	414.6
CENTER OF GRAVITY (IN)	431.3	431.3	426.3	419.4	412.8	406.6
BLANKET TENSION (LB)	3.00	3.00	4.98	8.85	13.83	19.92
MOMENT OF INERTIA I1	.1089+09	.1089+09	.1104+09	.1125+09	.1147+09	.1169+09
MOMENT OF INERTIA I2	.1112+07	.1112+07	.1114+07	.1117+07	.1121+07	.1126+07
SPECIFIC POWER (KW/KG)	.076	.076	.074	.071	.069	.066
SPECIFIC WEIGHT (KG/KW)	13.2	13.2	13.6	14.1	14.6	15.1
* BOOM PROPERTIES *						
DIAMETER (IN)	9.44	9.44	10.72	12.40	13.89	15.23
EI (LB*IN*SQ)	.37116+07	.37116+07	.61858+07	.11065+08	.17397+08	.25209+08
ROOT SPRING (LB*IN/RAD)	.6165+05	.6165+05	.9042+05	.1399+06	.1964+06	.2594+06
BUCKLING CAPABILITY RATIO	8.24	8.24	7.96	7.57	7.19	6.82
STRENGTH CAPABILITY RATIO	1.79	1.79	2.59	3.93	5.41	7.01
* CANNISTER PROPERTIES *						
HEIGHT (IN)	37.40	37.40	39.52	42.29	44.74	46.96
DIAMETER (IN)	11.14	11.14	12.65	14.63	16.38	17.98
* WEIGHTS (LB) *						
ARRAY	364.2	364.2	373.4	387.0	400.7	414.6
BOOM	15.2	15.2	19.7	26.3	33.0	39.7
CANNISTER	17.0	17.0	21.5	28.1	34.8	41.4
FULL TENSIONER	1.0	1.0	1.2	1.5	1.9	2.4
INTERMEDIATE TENSIONER	.9	.9	1.0	1.0	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	260.0	SUPPORT STRUCTURE =	3.1	INTERCONNECT HARNESS =	12.9
BOX COVER =	11.8	BOX HINGE =	.0	COVER LATCH =	3.2
CONTAINER =	28.7	MAST TIP FITTING =	2.3	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	1.5
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.2		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 12.5 KW ARRAY WIDTH = 5.50 M

ARRAY LENGTH = 22.91 M ASPECT RATIO = 4.17 BLANKET AREA = .19531+06 IN-SQ BLANKET WEIGHT = 260.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.023	.023	.028	.038	.047	.056
***** TORSIONAL FREQUENCY HZ *****	.044	.044	.055	.073	.091	.110
***** BENDING FREQUENCY HZ *****	.023	.023	.028	.038	.047	.056
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	164.0	164.0	166.9	172.0	177.1	182.3
ARRAY WEIGHT (LB)	360.9	360.9	367.1	378.4	389.7	401.1
CENTER OF GRAVITY (IN)	392.5	392.5	389.2	383.4	378.0	372.7
BLANKET TENSION (LB)	3.00	3.00	4.53	8.05	12.57	18.11
MOMENT OF INERTIA I1	.8928+08	.8928+08	.9006+08	.9148+08	.9290+08	.9433+08
MOMENT OF INERTIA I2	.1342+07	.1342+07	.1344+07	.1347+07	.1352+07	.1357+07
SPECIFIC POWER (KW/KG)	.076	.076	.075	.073	.071	.069
SPECIFIC WEIGHT (KG/KW)	13.1	13.1	13.3	13.8	14.2	14.6
* BOOM PROPERTIES *						
DIAMETER (IN)	8.99	8.99	9.97	11.53	12.91	14.16
EI (LB-IN-SQ)	.30598+07	.30598+07	.46292+07	.82700+07	.12985+08	.18791+08
ROOT SPRING (LB-IN/RAD)	.5333+05	.5333+05	.7275+05	.1124+06	.1577+06	.2081+06
BUCKLING CAPABILITY RATIO	7.97	7.97	7.71	7.28	6.87	6.49
STRENGTH CAPABILITY RATIO	1.72	1.72	2.32	3.53	4.88	6.34
* CANNISTER PROPERTIES *						
HEIGHT (IN)	34.68	34.68	36.30	38.87	41.14	43.20
DIAMETER (IN)	10.61	10.61	11.77	13.60	15.23	16.70
* WEIGHTS (LB) *						
ARRAY	360.9	360.9	367.1	378.4	389.7	401.1
BOOM	12.6	12.6	15.5	20.7	25.9	31.1
CANNISTER	15.3	15.3	18.5	24.3	30.0	35.7
FULL TENSIONER	1.0	1.0	1.2	1.5	1.8	2.2
INTERMEDIATE TENSIONER	.9	.9	.9	1.0	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	260.0	SUPPORT STRUCTURE =	3.1	INTERCONNECT HARNESS =	12.9
BOX COVER =	11.8	BOX HINGE =	.1	COVER LATCH =	3.2
CONTAINER =	29.9	MAST TIP FITTING =	2.3	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	1.5
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.1		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 12.5 KW   ARRAY WIDTH = 6.00 M

ARRAY LENGTH = 21.00 M   ASPECT RATIO = 3.50   BLANKET AREA = .19531+06 IN=SQ   BLANKET WEIGHT = 260.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.024	.024	.028	.038	.047	.056
***** TORSIONAL FREQUENCY HZ *****	.040	.040	.047	.063	.079	.095
***** BENDING FREQUENCY HZ *****	.024	.024	.028	.038	.047	.056
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	162.9	162.9	164.9	169.2	173.5	177.9
ARRAY WEIGHT (LB)	358.5	358.5	362.7	372.2	381.7	391.3
CENTER OF GRAVITY (IN)	359.9	359.9	357.7	352.9	348.4	343.9
BLANKET TENSION (LB)	3.00	3.00	4.15	7.38	11.53	16.60
MOMENT OF INERTIA I1	.7456+08	.7456+08	.7499+08	.7594+08	.7690+08	.7786+08
MOMENT OF INERTIA I2	.1595+07	.1595+07	.1596+07	.1601+07	.1605+07	.1611+07
SPECIFIC POWER (KW/KG)	.077	.077	.076	.074	.072	.070
SPECIFIC WEIGHT (KG/KW)	13.0	13.0	13.2	13.5	13.9	14.2
* BOOM PROPERTIES *						
DIAMETER (IN)	8.61	8.61	9.34	10.79	12.08	13.24
EI (LB*IN-SQ)	.25662+07	.25662+07	.35555+07	.63458+07	.99544+07	.14391+08
ROOT SPRING (LB=IN/RAD)	.4674+05	.4674+05	.5969+05	.9217+05	.1292+06	.1703+06
BUCKLING CAPABILITY RATIO	7.70	7.70	7.48	7.02	6.59	6.20
STRENGTH CAPABILITY RATIO	1.65	1.65	2.10	3.20	4.43	5.77
* CANNISTER PROPERTIES *						
HEIGHT (IN)	32.39	32.39	33.59	36.00	38.12	40.04
DIAMETER (IN)	10.15	10.15	11.02	12.73	14.25	15.63
* WEIGHTS (LB) *						
ARRAY	358.5	358.5	362.7	372.2	381.7	391.3
BOOM	10.5	10.5	12.4	16.6	20.8	25.0
CANNISTER	13.9	13.9	16.2	21.2	26.2	31.2
FULL TENSIONER	1.0	1.0	1.1	1.4	1.7	2.1
INTERMEDIATE TENSIONER	.9	.9	.9	1.0	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	260.0	SUPPORT STRUCTURE =	3.1	INTERCONNECT HARNESS =	12.9
BOX COVER =	11.8	BOX HINGE =	.1	COVER LATCH =	3.1
CONTAINER =	31.0	MAST TIP FITTING =	2.3	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	1.5
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	2.9		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 15.0 KW   ARRAY WIDTH = 4.00 M

ARRAY LENGTH = 37.80 M   ASPECT RATIO = 9.45   BLANKET AREA = .23438+06 IN=SQ   BLANKET WEIGHT = 312.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.017	.019	.028	.038	.047	.055
***** TORSIONAL FREQUENCY HZ *****	.067	.078	.117	.157	.198	.240
***** BENDING FREQUENCY HZ *****	.017	.019	.028	.038	.047	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	202.7	206.8	222.6	238.5	254.7	271.2
ARRAY WEIGHT (LB)	445.9	455.0	489.7	524.8	560.4	596.7
CENTER OF GRAVITY (IN)	656.3	651.7	635.5	621.3	608.6	597.1
BLANKET TENSION (LB)	3.00	3.98	8.96	15.93	24.89	35.85
MOMENT OF INERTIA I1	.3030+09	.3070+09	.3220+09	.3373+09	.3528+09	.3685+09
MOMENT OF INERTIA I2	.8174+06	.8180+06	.8207+06	.8242+06	.8286+06	.8340+06
SPECIFIC POWER (KW/KG)	.074	.073	.067	.063	.059	.055
SPECIFIC WEIGHT (KG/KW)	13.5	13.8	14.8	15.9	17.0	18.1
* BOOM PROPERTIES *						
DIAMETER (IN)	11.58	12.45	15.31	17.74	19.91	21.90
EI (LB-IN-SQ)	.84280+07	.11237+08	.25681+08	.46375+08	.73604+08	.10766+09
ROOT SPRING (LB-IN/RAD)	.1140+06	.1415+06	.2630+06	.4097+06	.5793+06	.7705+06
BUCKLING CAPABILITY RATIO	9.15	9.09	8.87	8.64	8.40	8.14
STRENGTH CAPABILITY RATIO	1.78	2.17	3.85	5.73	7.74	9.86
* CANNISTER PROPERTIES *						
HEIGHT (IN)	51.86	53.28	58.00	62.02	65.60	68.88
DIAMETER (IN)	13.67	14.69	18.06	20.94	23.50	25.84
* WEIGHTS (LB) *						
ARRAY	445.9	455.0	489.7	524.8	560.4	596.7
BOOM	34.4	39.7	60.1	80.7	101.7	123.0
CANNISTER	26.5	30.2	44.1	58.0	71.9	86.0
FULL TENSIONER	1.0	1.1	1.5	2.1	2.7	3.5
INTERMEDIATE TENSIONER	.9	.9	1.0	1.0	1.0	1.1

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	312.0	SUPPORT STRUCTURE =	3.3	INTERCONNECT HARNESS =	15.5
BOX COVER =	14.2	BOX HINGE =	.0	COVER LATCH =	1.5
CONTAINER =	30.3	MAST TIP FITTING =	1.9	MID TENSION MECHANISM =	.02
CONT BX CRUISE LATCH =	.0	CONT BX CVR CR LATCH =	.0	CONT BX DEPLOY DEVICE =	.0
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.3		

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 15.0 KW   ARRAY WIDTH = 4.50 M

ARRAY LENGTH = 33.60 M   ASPECT RATIO = 7.47   BLANKET AREA = .23438+06 IN=SQ   BLANKET WEIGHT = 312.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.018	.019	.028	.038	.047	.055
***** TORSIONAL FREQUENCY HZ *****	.057	.062	.093	.125	.157	.189
***** BENDING FREQUENCY HZ *****	.018	.019	.028	.038	.047	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	201.6	203.5	215.8	228.1	240.6	253.3
ARRAY WEIGHT (LB)	443.5	447.8	474.7	501.8	529.3	557.2
CENTER OF GRAVITY (IN)	578.4	576.3	563.8	552.5	542.3	532.8
BLANKET TENSION (LB)	3.00	3.54	7.97	14.16	22.13	31.87
MOMENT OF INERTIA I1	.2367+09	.2381+09	.2468+09	.2557+09	.2647+09	.2738+09
MOMENT OF INERTIA I2	.1070+07	.1071+07	.1074+07	.1078+07	.1083+07	.1089+07
SPECIFIC POWER (KW/KG)	.074	.074	.070	.066	.062	.059
SPECIFIC WEIGHT (KG/KW)	13.4	13.6	14.4	15.2	16.0	16.9
* BOOM PROPERTIES *						
DIAMETER (IN)	10.91	11.38	13.98	16.19	18.15	19.94
EI (LB-IN=SQ)	.66339+07	.78439+07	.17856+08	.32115+08	.50768+08	.73962+08
ROOT SPRING (LB-IN/RAD)	.9529+05	.1081+06	.2002+06	.3110+06	.4385+06	.5814+06
BUCKLING CAPABILITY RATIO	8.91	8.86	8.57	8.27	7.97	7.65
STRENGTH CAPABILITY RATIO	1.69	1.91	3.41	5.11	6.96	8.93
* CANNISTER PROPERTIES *						
HEIGHT (IN)	47.11	47.88	52.16	55.81	59.05	62.00
DIAMETER (IN)	12.88	13.43	16.49	19.10	21.42	23.53
* WEIGHTS (LB) *						
ARRAY	443.5	447.8	474.7	501.8	529.3	557.2
BOOM	27.1	29.5	44.5	59.7	75.1	90.6
CANNISTER	23.3	25.1	36.6	48.1	59.6	71.1
FULL TENSIONER	1.0	1.1	1.5	1.9	2.5	3.2
INTERMEDIATE TENSIONER	.9	.9	1.0	1.0	1.0	1.1

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	312.0	SUPPORT STRUCTURE =	3.3	INTERCONNECT HARNESS =	15.5
BOX COVER =	14.2	BOX HINGE =	.0	COVER LATCH =	3.7
CONTAINER =	31.1	MAST TIP FITTING =	2.4	MID TENSION MECHANISM =	.02
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	1.7
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.9		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 15.0 KW ARRAY WIDTH = 5.00 M

ARRAY LENGTH = 30.24 M ASPECT RATIO = 6.05 BLANKET AREA = .23438+06 IN*SQ BLANKET WEIGHT = 312.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.019	.019	.028	.038	.047	.055
***** TORSIONAL FREQUENCY HZ *****	.049	.051	.076	.102	.128	.154
***** BENDING FREQUENCY HZ *****	.019	.019	.028	.038	.047	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	198.4	199.0	208.8	218.7	228.6	238.7
ARRAY WEIGHT (LB)	436.5	437.8	459.4	481.1	503.0	525.2
CENTER OF GRAVITY (IN)	521.9	521.3	511.0	501.7	493.0	484.9
BLANKET TENSION (LB)	3.00	3.19	7.17	12.75	19.92	28.68
MOMENT OF INERTIA I1	.1892+09	.1896+09	.1950+09	.2005+09	.2060+09	.2116+09
MOMENT OF INERTIA I2	.1315+07	.1315+07	.1319+07	.1323+07	.1329+07	.1336+07
SPECIFIC POWER (KW/KG)	.076	.075	.072	.069	.066	.063
SPECIFIC WEIGHT (KG/KW)	13.2	13.3	13.9	14.6	15.2	15.9
* BOOM PROPERTIES *						
DIAMETER (IN)	10.34	10.50	12.89	14.92	16.71	18.35
EI (LB*IN*SQ)	.53517+07	.56875+07	.12912+08	.23161+08	.36514+08	.53054+08
ROOT SPRING (LB*IN/RAD)	.8111+05	.8490+05	.1570+06	.2434+06	.3424+06	.4532+06
BUCKLING CAPABILITY RATIO	8.67	8.65	8.29	7.94	7.59	7.24
STRENGTH CAPABILITY RATIO	1.62	1.70	3.05	4.60	6.29	8.11
* CANNISTER PROPERTIES *						
HEIGHT (IN)	43.26	43.52	47.46	50.80	53.77	56.47
DIAMETER (IN)	12.20	12.39	15.21	17.60	19.72	21.65
* WEIGHTS (LB) *						
ARRAY	436.5	437.8	459.4	481.1	503.0	525.2
BOOM	21.9	22.6	34.1	45.6	57.3	69.1
CANNISTER	20.7	21.3	31.0	40.7	50.4	60.1
FULL TENSIONER	1.0	1.0	1.4	1.8	2.4	3.0
INTERMEDIATE TENSIONER	.9	.9	1.0	1.0	1.0	1.1

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	312.0	SUPPORT STRUCTURE =	3.3	INTERCONNECT HARNESS =	15.5
BOX COVER =	14.2	BOX HINGE =	.0	COVER LATCH =	3.7
CONTAINER =	32.2	MAST TIP FITTING =	2.4	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	1.7
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.7		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 15.0 KW   ARRAY WIDTH = 5.50 M

ARRAY LENGTH = 27.49 M   ASPECT RATIO = 5.00   BLANKET AREA = .23438+06 IN*SQ   BLANKET WEIGHT = 312.0 LB

FREQUENCY DEPENDENT PARAMETERS

/***** MINIMUM FREQUENCY HZ *****	.019	.019	.028	.038	.047	.055
***** TORSIONAL FREQUENCY HZ *****	.043	.043	.064	.086	.107	.129
***** BENDING FREQUENCY HZ *****	.019	.019	.028	.038	.047	.055
*** ARRAY PROPERTIES ***						
ARRAY MASS (KG)	196.1	196.1	203.9	212.0	220.2	228.4
ARRAY WEIGHT (LB)	431.5	431.5	448.6	466.4	484.3	502.5
CENTER OF GRAVITY (IN)	475.2	475.2	467.1	459.3	452.0	445.0
BLANKET TENSION (LB)	3.00	3.00	6.52	11.59	18.11	26.07
MOMENT OF INERTIA I1	.1549+09	.1549+09	.1583+09	.1618+09	.1654+09	.1690+09
MOMENT OF INERTIA I2	.1587+07	.1587+07	.1591+07	.1596+07	.1602+07	.1609+07
SPECIFIC POWER (KW/KG)	.076	.076	.074	.071	.068	.066
SPECIFIC WEIGHT (KG/KW)	13.1	13.1	13.6	14.1	14.7	15.2
*** BOOM PROPERTIES ***						
DIAMETER (IN)	9.85	9.85	11.98	13.86	15.52	17.03
EI (LB*IN*SQ)	.44096+07	.44096+07	.96459+07	.17270+08	.27175+08	.39409+08
ROOT SPRING (LB*IN/RAD)	.7015+05	.7015+05	.1262+06	.1953+06	.2744+06	.3626+06
BUCKLING CAPABILITY RATIO	8.44	8.44	8.04	7.65	7.26	6.89
STRENGTH CAPABILITY RATIO	1.56	1.56	2.74	4.16	5.71	7.39
*** CANNISTER PROPERTIES ***						
HEIGHT (IN)	40.07	40.07	43.58	46.68	49.43	51.92
DIAMETER (IN)	11.63	11.63	14.14	16.35	18.32	20.10
*** WEIGHTS (LB) ***						
ARRAY	431.5	431.5	448.6	466.4	484.3	502.5
BOOM	18.1	18.1	26.8	35.8	44.9	54.1
CANNISTER	18.6	18.6	26.7	35.0	43.3	51.7
FULL TENSIONER	1.0	1.0	1.3	1.7	2.2	2.8
INTERMEDIATE TENSIONER	.9	.9	1.0	1.0	1.0	1.1

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	312.0	SUPPORT STRUCTURE =	3.3	INTERCONNECT HARNESS =	15.5
BOX COVER =	14.2	BOX HINGE =	.1	COVER LATCH =	3.6
CONTAINER =	33.3	MAST TIP FITTING =	2.4	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	1.7
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.4		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 15.0 KW   ARRAY WIDTH = 6.00 M

ARRAY LENGTH = 25.20 M   ASPECT RATIO = 4.20   BLANKET AREA = .23438+06 IN=SQ   BLANKET WEIGHT = 312.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.020	.020	.028	.038	.047	.055
***** TORSIONAL FREQUENCY HZ *****	.039	.039	.055	.073	.092	.111
***** BENDING FREQUENCY HZ *****	.020	.020	.028	.038	.047	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	194.5	194.5	200.4	207.2	214.0	220.9
ARRAY WEIGHT (LB)	427.9	427.9	440.8	455.7	470.7	485.9
CENTER OF GRAVITY (IN)	436.1	436.1	430.0	423.4	417.1	411.2
BLANKET TENSION (LB)	3.00	3.00	5.97	10.62	16.60	23.90
MOMENT OF INERTIA I1	.1292+09	.1292+09	.1313+09	.1337+09	.1361+09	.1385+09
MOMENT OF INERTIA I2	.1885+07	.1885+07	.1889+07	.1895+07	.1901+07	.1909+07
SPECIFIC POWER (KW/KG)	.077	.077	.075	.072	.070	.068
SPECIFIC WEIGHT (KG/KW)	13.0	13.0	13.4	13.8	14.3	14.7
* BOOM PROPERTIES *						
DIAMETER (IN)	9.43	9.43	11.21	12.97	14.52	15.93
EI (LB-IN-SQ)	.36968+07	.36968+07	.73992+07	.13229+08	.20788+08	.30105+08
ROOT SPRING (LB-IN/RAD)	.6146+05	.6146+05	.1034+06	.1599+06	.2244+06	.2963+06
BUCKLING CAPABILITY RATIO	8.21	8.21	7.81	7.38	6.97	6.58
STRENGTH CAPABILITY RATIO	1.50	1.50	2.49	3.78	5.21	6.76
* CANNISTER PROPERTIES *						
HEIGHT (IN)	37.38	37.38	40.33	43.22	45.78	48.11
DIAMETER (IN)	11.12	11.12	13.23	15.30	17.13	18.79
* WEIGHTS (LB) *						
ARRAY	427.9	427.9	440.8	455.7	470.7	485.9
BOOM	15.2	15.2	21.5	28.7	36.0	43.4
CANNISTER	16.9	16.9	23.3	30.6	37.8	45.1
FULL TENSIONER	1.0	1.0	1.3	1.7	2.1	2.7
INTERMEDIATE TENSIONER	.9	.9	1.0	1.0	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	312.0	SUPPORT STRUCTURE =	3.3	INTERCONNECT HARNESS =	15.5
BOX COVER =	14.2	BOX HINGE =	.1	COVER LATCH =	3.5
CONTAINER =	34.5	MAST TIP FITTING =	2.4	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	1.7
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.2		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 15.0 KW   ARRAY WIDTH = 6.50 M

ARRAY LENGTH = 23.26 M   ASPECT RATIO = 3.58   BLANKET AREA = .23438+06 IN=SQ   BLANKET WEIGHT = 312.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.021	.021	.028	.037	.047	.055
***** TORSIONAL FREQUENCY HZ *****	.035	.035	.048	.064	.081	.097
***** BENDING FREQUENCY HZ *****	.021	.021	.028	.037	.047	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	193.3	193.3	197.8	203.6	209.4	215.2
ARRAY WEIGHT (LB)	425.2	425.2	435.1	447.8	460.6	473.5
CENTER OF GRAVITY (IN)	402.7	402.7	398.1	392.5	387.1	382.0
BLANKET TENSION (LB)	3.00	3.00	5.52	9.80	15.32	22.06
MOMENT OF INERTIA I1	.1095+09	.1095+09	.1108+09	.1124+09	.1141+09	.1158+09
MOMENT OF INERTIA I2	.2211+07	.2211+07	.2215+07	.2221+07	.2228+07	.2237+07
SPECIFIC POWER (KW/KG)	.078	.078	.076	.074	.072	.070
SPECIFIC WEIGHT (KG/KW)	12.9	12.9	13.2	13.6	14.0	14.3
* BOOM PROPERTIES *						
DIAMETER (IN)	9.05	9.05	10.55	12.20	13.65	14.97
EI (LB=IN=SQ)	.31444+07	.31444+07	.58018+07	.10362+08	.16267+08	.23533+08
ROOT SPRING (LB=IN/RAD)	.5444+05	.5444+05	.8618+05	.1331+06	.1867+06	.2463+06
BUCKLING CAPABILITY RATIO	7.99	7.99	7.60	7.14	6.71	6.30
STRENGTH CAPABILITY RATIO	1.45	1.45	2.27	3.45	4.77	6.21
* CANNISTER PROPERTIES *						
HEIGHT (IN)	35.09	35.09	37.56	40.28	42.68	44.86
DIAMETER (IN)	10.68	10.68	12.45	14.39	16.11	17.67
* WEIGHTS (LB) *						
ARRAY	425.2	425.2	435.1	447.8	460.6	473.5
BOOM	12.9	12.9	17.6	23.5	29.4	35.4
CANNISTER	15.5	15.5	20.6	27.0	33.4	39.8
FULL TENSIONER	1.0	1.0	1.2	1.6	2.0	2.5
INTERMEDIATE TENSIONER	.9	.9	1.0	1.0	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	312.0	SUPPORT STRUCTURE =	3.3	INTERCONNECT HARNESS =	15.5
BOX COVER =	14.2	BOX HINGE =	.2	COVER LATCH =	3.5
CONTAINER =	35.6	MAST TIP FITTING =	2.4	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	1.7
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.1		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 15.0 KW   ARRAY WIDTH = 7.00 M

ARRAY LENGTH = 21.60 M   ASPECT RATIO = 3.09   BLANKET AREA = .23438+06 IN-SQ   BLANKET WEIGHT = 312.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.022	.022	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.033	.033	.043	.057	.072	.086
***** BENDING FREQUENCY HZ *****	.022	.022	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	192.4	192.4	195.9	200.9	205.9	210.9
ARRAY WEIGHT (LB)	423.2	423.2	430.9	441.9	452.9	464.0
CENTER OF GRAVITY (IN)	373.9	373.9	370.4	365.6	361.0	356.6
BLANKET TENSION (LB)	3.00	3.00	5.12	9.10	14.23	20.48
MOMENT OF INERTIA I1	.9396+08	.9396+08	.9479+08	.9597+08	.9716+08	.9836+08
MOMENT OF INERTIA I2	.2564+07	.2564+07	.2568+07	.2574+07	.2582+07	.2591+07
SPECIFIC POWER (KW/KG)	.078	.078	.077	.075	.073	.071
SPECIFIC WEIGHT (KG/KW)	12.8	12.8	13.1	13.4	13.7	14.1
* BOOM PROPERTIES *						
DIAMETER (IN)	8.72	8.72	9.98	11.53	12.90	14.15
EI (LB-IN-SQ)	.27074+07	.27074+07	.46344+07	.82707+07	.12973+08	.18753+08
ROOT SPRING (LB-IN/RAD)	.4866+05	.4866+05	.7281+05	.1124+06	.1576+06	.2077+06
BUCKLING CAPABILITY RATIO	7.76	7.76	7.39	6.91	6.46	6.05
STRENGTH CAPABILITY RATIO	1.40	1.40	2.08	3.17	4.39	5.72
* CANNISTER PROPERTIES *						
HEIGHT (IN)	33.10	33.10	35.17	37.73	40.00	42.05
DIAMETER (IN)	10.29	10.29	11.77	13.61	15.23	16.70
* WEIGHTS (LB) *						
ARRAY	423.2	423.2	430.9	441.9	452.9	464.0
BOOM	11.1	11.1	14.6	19.5	24.4	29.3
CANNISTER	14.3	14.3	18.4	24.1	29.8	35.4
FULL TENSIONER	1.0	1.0	1.2	1.5	1.9	2.4
INTERMEDIATE TENSIONER	.9	.9	1.0	1.0	1.0	1.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	312.0	SUPPORT STRUCTURE =	3.3	INTERCONNECT HARNESS =	15.5
BOX COVER =	14.2	BOX HINGE =	.3	COVER LATCH =	3.4
CONTAINER =	36.7	MAST TIP FITTING =	2.4	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	1.7
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.0		

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 20.0 KW   ARRAY WIDTH = 4.00 M

ARRAY LENGTH = 50.40 M   ASPECT RATIO = 12.60   BLANKET AREA = .31250+06 IN-SQ   BLANKET WEIGHT = 416.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.013	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.067	.104	.158	.213	.270	.329
***** BENDING FREQUENCY HZ *****	.013	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	275.8	299.5	333.9	369.2	405.5	442.8
ARRAY WEIGHT (LB)	606.9	658.8	734.5	812.2	892.0	974.1
CENTER OF GRAVITY (IN)	881.2	861.6	838.2	818.7	802.2	787.8
BLANKET TENSION (LB)	3.00	7.08	15.93	28.32	44.26	63.73
MOMENT OF INERTIA I1	.7367+09	.7812+09	.8464+09	.9134+09	.9823+09	.1053+10
MOMENT OF INERTIA I2	.1077+07	.1080+07	.1084+07	.1090+07	.1098+07	.1108+07
SPECIFIC POWER (KW/KG)	.073	.067	.060	.054	.049	.045
SPECIFIC WEIGHT (KG/KW)	13.8	15.0	16.7	18.5	20.3	22.1
* BOOM PROPERTIES *						
DIAMETER (IN)	13.40	16.69	20.59	23.94	26.95	29.73
EI (LB-IN-SQ)	.15097+08	.36334+08	.84060+08	.15366+09	.24686+09	.36549+09
ROOT SPRING (LB-IN/RAD)	.1766+06	.3412+06	.6400+06	.1006+07	.1436+07	.1927+07
BUCKLING CAPABILITY RATIO	9.59	9.56	9.51	9.43	9.32	9.16
STRENGTH CAPABILITY RATIO	1.51	2.74	4.74	6.90	9.15	11.45
* CANNISTER PROPERTIES *						
HEIGHT (IN)	65.77	71.20	77.62	83.15	88.12	92.71
DIAMETER (IN)	15.81	19.70	24.29	28.25	31.80	35.08
* WEIGHTS (LB) *						
ARRAY	606.9	658.8	734.5	812.2	892.0	974.1
BOOM	61.4	95.3	144.9	195.9	248.3	302.1
CANNISTER	36.5	54.2	79.6	105.3	131.5	158.2
FULL TENSIONER	1.0	1.4	2.1	3.0	4.2	5.6
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.1	1.1	1.2

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	416.0	SUPPORT STRUCTURE =	3.8	INTERCONNECT HARNESS =	20.7
BOX COVER =	18.9	BOX HINGE =	.0	COVER LATCH =	1.9
CONTAINER =	38.3	MAST TIP FITTING =	2.1	MID TENSION MECHANISM =	.02
CONT BX CRUISE LATCH =	.0	CONT BX CVR CR LATCH =	.0	CONT BX DEPLOY DEVICE =	.0
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.3		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 20.0 KW   ARRAY WIDTH = 4.50 M

ARRAY LENGTH = 44.80 M   ASPECT RATIO = 9.96   BLANKET AREA = .31250+06 IN-SQ   BLANKET WEIGHT = 416.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.013	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.056	.082	.124	.167	.211	.256
***** BENDING FREQUENCY HZ *****	.013	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	271.7	287.8	314.1	341.0	368.3	396.3
ARRAY WEIGHT (LB)	597.8	633.2	691.1	750.1	810.3	871.9
CENTER OF GRAVITY (IN)	778.6	765.1	746.2	729.9	715.5	702.8
BLANKET TENSION (LB)	3.00	6.29	14.16	25.18	39.34	56.65
MOMENT OF INERTIA I1	.5712+09	.5942+09	.6319+09	.6705+09	.7098+09	.7499+09
MOMENT OF INERTIA I2	.1402+07	.1405+07	.1410+07	.1416+07	.1425+07	.1436+07
SPECIFIC POWER (KW/KG)	.074	.069	.064	.059	.054	.050
SPECIFIC WEIGHT (KG/KW)	13.6	14.4	15.7	17.0	18.4	19.8
* BOOM PROPERTIES *						
DIAMETER (IN)	12.62	15.23	18.75	21.77	24.46	26.94
EI (LB-IN-SQ)	.11855+08	.25194+08	.57875+08	.10504+09	.16756+09	.24634+09
ROOT SPRING (LB-IN/RAD)	.1473+06	.2592+06	.4837+06	.7564+06	.1074+07	.1433+07
BUCKLING CAPABILITY RATIO	9.39	9.30	9.14	8.96	8.75	8.50
STRENGTH CAPABILITY RATIO	1.44	2.44	4.28	6.30	8.44	10.66
* CANNISTER PROPERTIES *						
HEIGHT (IN)	59.62	63.94	69.75	74.72	79.17	83.25
DIAMETER (IN)	14.89	17.97	22.13	25.68	28.86	31.78
* WEIGHTS (LB) *						
ARRAY	597.8	633.2	691.1	750.1	810.3	871.9
BOOM	48.4	70.5	106.9	144.0	181.8	220.5
CANNISTER	32.0	44.9	65.8	86.8	108.1	129.6
FULL TENSIONER	1.0	1.3	1.9	2.7	3.8	5.1
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.0	1.1	1.2

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	416.0	SUPPORT STRUCTURE =	3.8	INTERCONNECT HARNESS =	20.7
BOX COVER =	18.9	BOX HINGE =	.0	COVER LATCH =	5.2
CONTAINER =	38.0	MAST TIP FITTING =	2.6	MID TENSION MECHANISM =	.02
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	2.3
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.8		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 20.0 KW   ARRAY WIDTH = 5.00 M

ARRAY LENGTH = 40.32 M   ASPECT RATIO = 8.06   BLANKET AREA = .31250+06 IN-SQ   BLANKET WEIGHT = 416.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.014	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.048	.067	.101	.135	.170	.206
***** BENDING FREQUENCY HZ *****	.014	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	266.2	277.4	298.2	319.3	340.8	362.6
ARRAY WEIGHT (LB)	585.5	610.3	656.1	702.5	749.7	797.8
CENTER OF GRAVITY (IN)	702.9	693.2	677.3	663.1	650.5	639.0
BLANKET TENSION (LB)	3.00	5.66	12.75	22.66	35.41	50.98
MOMENT OF INERTIA I1	.4549+09	.4673+09	.4906+09	.5142+09	.5381+09	.5625+09
MOMENT OF INERTIA I2	.1723+07	.1725+07	.1731+07	.1738+07	.1748+07	.1760+07
SPECIFIC POWER (KW/KG)	.075	.072	.067	.063	.059	.055
SPECIFIC WEIGHT (KG/KW)	13.3	13.9	14.9	16.0	17.0	18.1
* BOOM PROPERTIES *						
DIAMETER (IN)	11.95	14.04	17.27	20.02	22.47	24.71
EI (LB-IN-SQ)	.95504+07	.18191+08	.41588+08	.75121+08	.11926+09	.17449+09
ROOT SPRING (LB-IN/RAD)	.1252+06	.2031+06	.3775+06	.5882+06	.8320+06	.1107+07
BUCKLING CAPABILITY RATIO	9.21	9.07	8.83	8.58	8.30	7.99
STRENGTH CAPABILITY RATIO	1.39	2.19	3.87	5.76	7.78	9.90
* CANNISTER PROPERTIES *						
HEIGHT (IN)	54.65	58.09	63.41	67.95	72.00	75.70
DIAMETER (IN)	14.10	16.57	20.37	23.62	26.51	29.16
* WEIGHTS (LB) *						
ARRAY	585.5	610.3	656.1	702.5	749.7	797.8
BOOM	39.1	53.9	81.5	109.6	138.1	167.0
CANNISTER	28.4	38.0	55.6	73.2	90.9	108.8
FULL TENSIONER	1.0	1.3	1.8	2.6	3.5	4.7
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.0	1.1	1.2

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	416.0	SUPPORT STRUCTURE =	3.8	INTERCONNECT HARNESS =	20.7
BOX COVER =	18.9	BOX HINGE =	.0	COVER LATCH =	5.0
CONTAINER =	39.1	MAST TIP FITTING =	2.6	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	2.3
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.5		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 20.0 KW   ARRAY WIDTH = 5.50 M

ARRAY LENGTH = 36.66 M   ASPECT RATIO = 6.66   BLANKET AREA = .31250+06 IN=SQ   BLANKET WEIGHT = 416.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.015	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.042	.055	.084	.112	.141	.170
***** BENDING FREQUENCY HZ *****	.015	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	262.1	270.0	286.9	304.0	321.4	339.0
ARRAY WEIGHT (LB)	576.5	594.1	631.3	668.9	707.0	745.8
CENTER OF GRAVITY (IN)	640.6	633.6	620.1	607.9	596.8	586.6
BLANKET TENSION (LB)	3.00	5.15	11.59	20.60	32.19	46.35
MOMENT OF INERTIA I1	.3712+09	.3782+09	.3932+09	.4084+09	.4238+09	.4394+09
MOMENT OF INERTIA I2	.2078+07	.2080+07	.2087+07	.2095+07	.2106+07	.2119+07
SPECIFIC POWER (KW/KG)	.076	.074	.070	.066	.062	.059
SPECIFIC WEIGHT (KG/KW)	13.1	13.5	14.3	15.2	16.1	16.9
* BOOM PROPERTIES *						
DIAMETER (IN)	11.38	13.05	16.03	18.57	20.83	22.89
EI (LB-IN=SQ)	.78612+07	.13576+08	.30931+08	.55683+08	.88103+08	.12847+09
ROOT SPRING (LB=IN/RAD)	.1082+06	.1630+06	.3024+06	.4699+06	.6629+06	.8797+06
BUCKLING CAPABILITY RATIO	9.03	8.88	8.57	8.26	7.92	7.58
STRENGTH CAPABILITY RATIO	1.34	1.97	3.52	5.27	7.16	9.17
* CANNISTER PROPERTIES *						
HEIGHT (IN)	50.53	53.28	58.21	62.39	66.12	69.52
DIAMETER (IN)	13.43	15.40	18.92	21.92	24.58	27.01
* WEIGHTS (LB) *						
ARRAY	576.5	594.1	631.3	668.9	707.0	745.8
BOOM	32.2	42.3	63.9	85.8	107.9	130.3
CANNISTER	25.5	32.7	47.8	62.9	78.0	93.2
FULL TENSIONER	1.0	1.2	1.7	2.4	3.3	4.3
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.0	1.1	1.1

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	416.0	SUPPORT STRUCTURE =	3.8	INTERCONNECT HARNESS =	20.7
BOX COVER =	18.9	BOX HINGE =	.1	COVER LATCH =	4.8
CONTAINER =	40.3	MAST TIP FITTING =	2.6	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	2.3
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.2		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 20.0 KW ARRAY WIDTH = 6.00 M

ARRAY LENGTH = 33.60 M ASPECT RATIO = 5.60 BLANKET AREA = .31250+06 IN=SQ BLANKET WEIGHT = 416.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.015	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.038	.047	.071	.095	.120	.144
***** BENDING FREQUENCY HZ *****	.015	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	259.0	264.7	278.7	292.9	307.2	321.8
ARRAY WEIGHT (LB)	569.8	582.3	613.2	644.4	675.9	707.9
CENTER OF GRAVITY (IN)	588.2	583.2	571.7	561.2	551.5	542.5
BLANKET TENSION (LB)	3.00	4.72	10.62	18.88	29.51	42.49
MOMENT OF INERTIA I1	.3089+09	.3129+09	.3230+09	.3332+09	.3435+09	.3539+09
MOMENT OF INERTIA I2	.2468+07	.2470+07	.2477+07	.2486+07	.2498+07	.2512+07
SPECIFIC POWER (KW/KG)	.077	.076	.072	.068	.065	.062
SPECIFIC WEIGHT (KG/KW)	13.0	13.2	13.9	14.6	15.4	16.1
* BOOM PROPERTIES *						
DIAMETER (IN)	10.89	12.21	14.99	17.36	19.45	21.36
EI (LB=IN=SQ)	.65855+07	.10405+08	.23650+08	.42471+08	.67035+08	.97510+08
ROOT SPRING (LB=IN/RAD)	.9477+05	.1336+06	.2472+06	.3835+06	.5401+06	.7153+06
BUCKLING CAPABILITY RATIO	8.85	8.70	8.34	7.97	7.60	7.23
STRENGTH CAPABILITY RATIO	1.29	1.79	3.21	4.83	6.60	8.49
* CANNISTER PROPERTIES *						
HEIGHT (IN)	47.08	49.25	53.84	57.74	61.20	64.36
DIAMETER (IN)	12.85	14.41	17.69	20.48	22.96	25.21
* WEIGHTS (LB) *						
ARRAY	569.8	582.3	613.2	644.4	675.9	707.9
BOOM	27.0	34.0	51.2	68.7	86.3	104.0
CANNISTER	23.2	28.5	41.7	54.8	67.9	81.0
FULL TENSIONER	1.0	1.2	1.7	2.3	3.1	4.0
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.0	1.1	1.1

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	416.0	SUPPORT STRUCTURE =	3.8	INTERCONNECT HARNESS =	20.7
BOX COVER =	18.9	BOX HINGE =	.2	COVER LATCH =	4.6
CONTAINER =	41.4	MAST TIP FITTING =	2.6	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	2.3
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.9		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 20.0 KW   ARRAY WIDTH = 6.50 M

ARRAY LENGTH = 31.02 M   ASPECT RATIO = 4.77   BLANKET AREA = .31250+06 IN=SQ   BLANKET WEIGHT = 416.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.016	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.034	.041	.061	.082	.103	.124
***** BENDING FREQUENCY HZ *****	.016	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	256.7	260.7	272.6	284.5	296.6	308.9
ARRAY WEIGHT (LB)	564.7	573.6	599.7	626.0	652.6	679.5
CENTER OF GRAVITY (IN)	543.5	540.0	530.2	521.2	512.7	504.7
BLANKET TENSION (LB)	3.00	4.36	9.80	17.43	27.24	39.22
MOMENT OF INERTIA I1	.2612+09	.2635+09	.2705+09	.2776+09	.2847+09	.2919+09
MOMENT OF INERTIA I2	.2893+07	.2895+07	.2903+07	.2912+07	.2925+07	.2941+07
SPECIFIC POWER (KW/KG)	.078	.077	.073	.070	.067	.065
SPECIFIC WEIGHT (KG/KW)	12.8	13.0	13.6	14.2	14.8	15.4
* BOOM PROPERTIES *						
DIAMETER (IN)	10.46	11.49	14.10	16.32	18.28	20.06
EI (LB-IN-SQ)	.55980+07	.81543+07	.18500+08	.33161+08	.52244+08	.75857+08
ROOT SPRING (LB=IN/RAD)	.8390+05	.1112+06	.2056+06	.3186+06	.4480+06	.5925+06
BUCKLING CAPABILITY RATIO	8.68	8.53	8.12	7.72	7.32	6.92
STRENGTH CAPABILITY RATIO	1.25	1.64	2.95	4.45	6.10	7.88
* CANNISTER PROPERTIES *						
HEIGHT (IN)	44.12	45.82	50.13	53.79	57.03	59.97
DIAMETER (IN)	12.34	13.56	16.64	19.25	21.57	23.68
* WEIGHTS (LB) *						
ARRAY	564.7	573.6	599.7	626.0	652.6	679.5
BOOM	23.0	27.8	41.8	56.0	70.3	84.7
CANNISTER	21.2	25.2	36.8	48.3	59.8	71.3
FULL TENSIONER	1.0	1.1	1.6	2.2	2.9	3.8
INTERMEDIATE TENSIONER	.9	.9	1.0	1.0	1.1	1.1

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	416.0	SUPPORT STRUCTURE =	3.8	INTERCONNECT HARNESS =	20.7
BOX COVER =	18.9	BOX HINGE =	.2	COVER LATCH =	4.5
CONTAINER =	42.6	MAST TIP FITTING =	2.6	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CP LATCH =	.4	CONT BX DEPLOY DEVICE =	2.3
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.7		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 20.0 KW   ARRAY WIDTH = 7.00 M

ARRAY LENGTH = 28.80 M   ASPECT RATIO = 4.11   BLANKET AREA = .31250+06 IN=SQ   BLANKET WEIGHT = 416.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.016	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.031	.036	.054	.072	.091	.109
***** BENDING FREQUENCY HZ *****	.016	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	254.9	257.7	267.9	278.2	288.5	299.0
ARRAY WEIGHT (LB)	560.8	567.0	589.4	612.0	634.7	657.7
CENTER OF GRAVITY (IN)	505.1	502.6	494.2	486.4	479.0	471.9
BLANKET TENSION (LB)	3.00	4.05	9.10	16.19	25.29	36.42
MOMENT OF INERTIA I1	.2238+09	.2252+09	.2302+09	.2352+09	.2403+09	.2454+09
MOMENT OF INERTIA I2	.3353+07	.3355+07	.3363+07	.3374+07	.3388+07	.3404+07
SPECIFIC POWER (KW/KG)	.078	.078	.075	.072	.069	.067
SPECIFIC WEIGHT (KG/KW)	12.7	12.9	13.4	13.9	14.4	14.9
* BOOM PROPERTIES *						
DIAMETER (IN)	10.07	10.86	13.32	15.41	17.26	18.94
EI (LB=IN=SQ)	.48177+07	.65106+07	.14750+08	.26403+08	.41539+08	.60228+08
ROOT SPRING (LB=IN/RAD)	.7497+05	.9396+05	.1735+06	.2685+06	.3772+06	.4984+06
BUCKLING CAPABILITY RATIO	8.51	8.38	7.93	7.49	7.06	6.65
STRENGTH CAPABILITY RATIO	1.21	1.50	2.72	4.11	5.66	7.32
* CANNISTER PROPERTIES *						
HEIGHT (IN)	41.57	42.87	46.93	50.38	53.43	56.20
DIAMETER (IN)	11.89	12.82	15.72	18.19	20.37	22.35
* WEIGHTS (LB) *						
ARRAY	560.8	567.0	589.4	612.0	634.7	657.7
BOOM	19.8	23.0	34.7	46.4	58.2	70.1
CANNISTER	19.6	22.4	32.8	43.0	53.2	63.5
FULL TENSIONER	1.0	1.1	1.5	2.1	2.8	3.6
INTERMEDIATE TENSIONER	.9	.9	1.0	1.0	1.0	1.1

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	416.0	SUPPORT STRUCTURE =	3.8	INTERCONNECT HARNESS =	20.7
BOX COVER =	18.9	BOX HINGE =	.3	COVER LATCH =	4.4
CONTAINER =	43.7	MAST TIP FITTING =	2.6	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	2.3
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.5		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 25.0 KW ARRAY WIDTH = 5.00 M

ARRAY LENGTH = 50.40 M ASPECT RATIO = 10.08 BLANKET AREA = .39063+06 IN-SQ BLANKET WEIGHT = 520.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.048	.083	.126	.170	.216	.262
***** BENDING FREQUENCY HZ *****	.011	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	336.6	368.0	406.2	445.3	485.4	526.5
ARRAY WEIGHT (LB)	740.6	809.6	893.6	979.6	1067.9	1158.3
CENTER OF GRAVITY (IN)	883.4	862.1	840.7	822.6	806.9	793.1
BLANKET TENSION (LB)	3.00	8.85	19.92	35.41	55.32	79.66
MOMENT OF INERTIA I1	.9023+09	.9614+09	.1034+10	.1108+10	.1184+10	.1262+10
MOMENT OF INERTIA I2	.2133+07	.2138+07	.2146+07	.2158+07	.2173+07	.2192+07
SPECIFIC POWER (KW/KG)	.074	.068	.062	.056	.052	.047
SPECIFIC WEIGHT (KG/KW)	13.5	14.7	16.2	17.8	19.4	21.1
* BOOM PROPERTIES *						
DIAMETER (IN)	13.38	17.63	21.72	25.24	28.39	31.30
EI (LB-IN-SQ)	.14991+08	.45162+08	.10418+09	.18987+09	.30415+09	.44899+09
ROOT SPRING (LB-IN/RAD)	.1756+06	.4016+06	.7517+06	.1179+07	.1679+07	.2249+07
BUCKLING CAPABILITY RATIO	9.52	9.43	9.32	9.17	8.98	8.74
STRENGTH CAPABILITY RATIO	1.22	2.62	4.56	6.67	8.88	11.16
* CANNISTER PROPERTIES *						
HEIGHT (IN)	65.73	72.74	79.50	85.30	90.50	95.30
DIAMETER (IN)	15.79	20.80	25.63	29.78	33.50	36.93
* WEIGHTS (LB) *						
ARRAY	740.6	809.6	893.6	979.6	1067.9	1158.3
BOOM	61.2	106.2	161.3	217.7	275.6	334.8
CANNISTER	36.4	59.9	87.9	116.3	145.0	174.3
FULL TENSIONER	1.0	1.5	2.4	3.5	5.0	6.8
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.1	1.2	1.3

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	520.0	SUPPORT STRUCTURE =	4.2	INTERCONNECT HARNESS =	25.8
BOX COVER =	23.7	BOX HINGE =	.1	COVER LATCH =	7.0
CONTAINER =	46.1	MAST TIP FITTING =	2.7	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	2.9
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.3		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 25.0 KW   ARRAY WIDTH = 5.50 M

ARRAY LENGTH = 45.82 M   ASPECT RATIO = 8.33   BLANKET AREA = .39063+06 IN=SQ   BLANKET WEIGHT = 520.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.012	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.042	.069	.104	.140	.177	.215
***** BENDING FREQUENCY HZ *****	.012	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	330.3	353.9	384.6	416.0	447.9	480.6
ARRAY WEIGHT (LB)	726.6	778.6	846.2	915.1	985.4	1057.3
CENTER OF GRAVITY (IN)	805.4	788.6	770.1	753.9	739.6	726.8
BLANKET TENSION (LB)	3.00	8.05	18.11	32.19	50.29	72.42
MOMENT OF INERTIA I1	.7340+09	.7697+09	.8162+09	.8637+09	.9121+09	.9610+09
MOMENT OF INERTIA I2	.2571+07	.2577+07	.2586+07	.2599+07	.2616+07	.2637+07
SPECIFIC POWER (KW/KG)	.076	.071	.065	.060	.056	.052
SPECIFIC WEIGHT (KG/KW)	13.2	14.2	15.4	16.6	17.9	19.2
* BOOM PROPERTIES *						
DIAMETER (IN)	12.74	16.37	20.14	23.37	26.26	28.91
EI (LB=IN=SQ)	.12327+08	.33575+08	.77041+08	.13967+09	.22256+09	.32684+09
ROOT SPRING (LB=IN/RAD)	.1517+06	.3215+06	.5995+06	.9366+06	.1328+07	.1772+07
BUCKLING CAPABILITY RATIO	9.37	9.22	9.02	8.79	8.53	8.22
STRENGTH CAPABILITY RATIO	1.18	2.39	4.19	6.19	8.31	10.51
* CANNISTER PROPERTIES *						
HEIGHT (IN)	60.71	66.69	72.92	78.25	83.02	87.39
DIAMETER (IN)	15.03	19.31	23.77	27.58	30.99	34.11
* WEIGHTS (LB) *						
ARRAY	726.6	778.6	846.2	915.1	985.4	1057.3
BOOM	50.4	83.2	126.1	169.8	214.3	259.7
CANNISTER	32.7	51.4	75.4	99.5	123.8	148.5
FULL TENSIONER	1.0	1.5	2.2	3.3	4.6	6.3
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.1	1.2	1.3

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	520.0	SUPPORT STRUCTURE =	4.2	INTERCONNECT HARNESS =	25.8
BOX COVER =	23.7	BOX HINGE =	.1	COVER LATCH =	6.7
CONTAINER =	47.2	MAST TIP FITTING =	2.7	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	2.9
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.9		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 25.0 KW   ARRAY WIDTH = 6.00 M

ARRAY LENGTH = 42.00 M   ASPECT RATIO = 7.00   BLANKET AREA = .39063+06 IN=SQ   BLANKET WEIGHT = 520.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.012	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.037	.058	.088	.118	.149	.180
***** BENDING FREQUENCY HZ *****	.012	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	325.5	343.6	369.0	394.7	420.8	447.4
ARRAY WEIGHT (LB)	716.0	756.0	811.7	868.3	925.8	984.4
CENTER OF GRAVITY (IN)	739.8	726.7	710.6	696.3	683.4	671.7
BLANKET TENSION (LB)	3.00	7.38	16.60	29.51	46.10	66.39
MOMENT OF INERTIA I1	.6094+09	.6317+09	.6628+09	.6945+09	.7267+09	.7593+09
MOMENT OF INERTIA I2	.3053+07	.3059+07	.3069+07	.3083+07	.3102+07	.3124+07
SPECIFIC POWER (KW/KG)	.077	.073	.068	.063	.059	.056
SPECIFIC WEIGHT (KG/KW)	13.0	13.7	14.8	15.8	16.8	17.9
* BOOM PROPERTIES *						
DIAMETER (IN)	12.19	15.30	18.82	21.81	24.48	26.93
EI (LB=IN=SQ)	.10319+08	.25664+08	.58662+08	.10595+09	.16818+09	.24603+09
ROOT SPRING (LB=IN/RAD)	.1327+06	.2629+06	.4886+06	.7613+06	.1077+07	.1432+07
BUCKLING CAPABILITY RATIO	9.22	9.03	8.77	8.48	8.16	7.81
STRENGTH CAPABILITY RATIO	1.14	2.18	3.86	5.74	7.76	9.87
* CANNISTER PROPERTIES *						
HEIGHT (IN)	56.49	61.63	67.43	72.37	76.78	80.81
DIAMETER (IN)	14.38	18.06	22.20	25.74	28.89	31.77
* WEIGHTS (LB) *						
ARRAY	716.0	756.0	811.7	868.3	925.8	984.4
BOOM	42.3	66.7	100.9	135.5	170.8	206.5
CANNISTER	29.6	44.8	65.6	86.5	107.4	128.6
FULL TENSIONER	1.0	1.4	2.1	3.1	4.3	5.8
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.1	1.1	1.2

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	520.0	SUPPORT STRUCTURE =	4.2	INTERCONNECT HARNESS =	25.8
BOX COVER =	23.7	BOX HINGE =	.2	COVER LATCH =	6.4
CONTAINER =	48.4	MAST TIP FITTING =	2.7	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	2.9
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.6		

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 25.0 KW   ARRAY WIDTH = 6.50 M

ARRAY LENGTH = 38.77 M   ASPECT RATIO = 5.96   BLANKET AREA = .39063+06 IN=SQ   BLANKET WEIGHT = 520.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.013	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.033	.050	.076	.101	.127	.154
***** BENDING FREQUENCY HZ *****	.013	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	321.8	336.0	357.2	378.7	400.6	422.8
ARRAY WEIGHT (LB)	707.9	739.1	785.9	833.2	881.3	930.1
CENTER OF GRAVITY (IN)	684.0	673.7	659.7	647.1	635.5	624.9
BLANKET TENSION (LB)	3.00	6.81	15.32	27.24	42.56	61.28
MOMENT OF INERTIA I1	.5143+09	.5287+09	.5503+09	.5722+09	.5943+09	.6168+09
MOMENT OF INERTIA I2	.3577+07	.3583+07	.3595+07	.3610+07	.3630+07	.3654+07
SPECIFIC POWER (KW/KG)	.078	.074	.070	.066	.062	.059
SPECIFIC WEIGHT (KG/KW)	12.9	13.4	14.3	15.1	16.0	16.9
* BOOM PROPERTIES *						
DIAMETER (IN)	11.70	14.39	17.68	20.48	22.97	25.25
EI (LB-IN-SQ)	.87663+07	.20070+08	.45745+08	.82383+08	.13040+09	.19021+09
ROOT SPRING (LB-IN/RAD)	.1174+06	.2186+06	.4055+06	.6304+06	.8896+06	.1181+07
BUCKLING CAPABILITY RATIO	9.08	8.87	8.54	8.20	7.84	7.46
STRENGTH CAPABILITY RATIO	1.11	2.00	3.57	5.33	7.24	9.26
* CANNISTER PROPERTIES *						
HEIGHT (IN)	52.88	57.33	62.76	67.38	71.49	75.24
DIAMETER (IN)	13.80	16.98	20.86	24.17	27.11	29.79
* WEIGHTS (LB) *						
ARRAY	707.9	739.1	785.9	833.2	881.3	930.1
BOOM	36.0	54.5	82.2	110.3	138.8	167.6
CANNISTER	27.1	39.5	57.8	76.1	94.4	112.9
FULL TENSIONER	1.0	1.4	2.0	2.9	4.1	5.5
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.1	1.1	1.2

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	520.0	SUPPORT STRUCTURE =	4.2	INTERCONNECT HARNESS =	25.8
BOX COVER =	23.7	BOX HINGE =	.3	COVER LATCH =	6.2
CONTAINER =	49.5	MAST TIP FITTING =	2.7	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	2.9
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.3		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 25.0 KW   ARRAY WIDTH = 7.00 M

ARRAY LENGTH = 36.00 M   ASPECT RATIO = 5.14   BLANKET AREA = .39063+06 IN-SQ   BLANKET WEIGHT = 520.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.013	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.030	.044	.066	.088	.111	.134
***** BENDING FREQUENCY HZ *****	.013	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	318.9	330.1	348.2	366.5	385.1	403.9
ARRAY WEIGHT (LB)	701.6	726.3	766.1	806.4	847.2	888.6
CENTER OF GRAVITY (IN)	635.9	627.7	615.5	604.4	594.1	584.5
BLANKET TENSION (LB)	3.00	6.32	14.23	25.29	39.52	56.90
MOMENT OF INERTIA I1	.4401+09	.4496+09	.4650+09	.4806+09	.4963+09	.5122+09
MOMENT OF INERTIA I2	.4145+07	.4151+07	.4163+07	.4180+07	.4201+07	.4228+07
SPECIFIC POWER (KW/KG)	.078	.076	.072	.068	.065	.062
SPECIFIC WEIGHT (KG/KW)	12.8	13.2	13.9	14.7	15.4	16.2
* BOOM PROPERTIES *						
DIAMETER (IN)	11.27	13.60	16.70	19.33	21.67	23.81
EI (LB-IN-SQ)	.75409+07	.15999+08	.36387+08	.65386+08	.10327+09	.15031+09
ROOT SPRING (LB-IN/RAD)	.1049+06	.1844+06	.3415+06	.5301+06	.7468+06	.9896+06
BUCKLING CAPABILITY RATIO	8.95	8.71	8.34	7.95	7.55	7.15
STRENGTH CAPABILITY RATIO	1.07	1.84	3.30	4.96	6.76	8.69
* CANNISTER PROPERTIES *						
HEIGHT (IN)	49.77	53.62	58.74	63.08	66.94	70.46
DIAMETER (IN)	13.29	16.05	19.70	22.81	25.57	28.09
* WEIGHTS (LB) *						
ARRAY	701.6	726.3	766.1	806.4	847.2	888.6
BOOM	31.0	45.1	68.1	91.3	114.7	138.4
CANNISTER	25.0	35.2	51.4	67.6	83.9	100.2
FULL TENSIONER	1.0	1.3	1.9	2.8	3.8	5.1
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.0	1.1	1.2

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	520.0	SUPPORT STRUCTURE =	4.2	INTERCONNECT HARNESS =	25.8
BOX COVER =	23.7	BOX HINGE =	.4	COVER LATCH =	5.9
CONTAINER =	50.6	MAST TIP FITTING =	2.7	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	2.9
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.1		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 25.0 KW   ARRAY WIDTH = 7.50 M

ARRAY LENGTH = 33.60 M   ASPECT RATIO = 4.48   BLANKET AREA = .39063+06 IN-SQ   BLANKET WEIGHT = 520.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.014	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.028	.039	.058	.078	.098	.118
***** BENDING FREQUENCY HZ *****	.014	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	316.6	325.6	341.2	357.0	373.0	389.2
ARRAY WEIGHT (LB)	696.6	716.3	750.7	785.4	820.6	856.2
CENTER OF GRAVITY (IN)	594.0	587.5	576.8	567.0	557.8	549.1
BLANKET TENSION (LB)	3.00	5.90	13.28	23.60	36.88	53.11
MOMENT OF INERTIA I1	.3811+09	.3875+09	.3987+09	.4100+09	.4215+09	.4330+09
MOMENT OF INERTIA I2	.4756+07	.4762+07	.4775+07	.4793+07	.4816+07	.4844+07
SPECIFIC POWER (KW/KG)	.079	.077	.073	.070	.067	.064
SPECIFIC WEIGHT (KG/KW)	12.7	13.0	13.6	14.3	14.9	15.6
* BOOM PROPERTIES *						
DIAMETER (IN)	10.88	12.90	15.84	18.33	20.54	22.55
EI (LB-IN-SQ)	.65565+07	.12964+08	.29433+08	.52801+08	.83251+08	.12097+09
ROOT SPRING (LB-IN/RAD)	.9446+05	.1575+06	.2913+06	.4516+06	.6354+06	.8409+06
BUCKLING CAPABILITY RATIO	8.81	8.57	8.15	7.73	7.30	6.88
STRENGTH CAPABILITY RATIO	1.04	1.71	3.07	4.62	6.33	8.15
* CANNISTER PROPERTIES *						
HEIGHT (IN)	47.06	50.39	55.23	59.34	62.99	66.31
DIAMETER (IN)	12.84	15.22	18.69	21.63	24.23	26.61
* WEIGHTS (LB) *						
ARRAY	696.6	716.3	750.7	785.4	820.6	856.2
BOOM	27.0	37.9	57.2	76.5	96.1	115.9
CANNISTER	23.1	31.6	46.1	60.7	75.2	89.8
FULL TENSIONER	1.0	1.3	1.9	2.6	3.6	4.8
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.0	1.1	1.2

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	520.0	SUPPORT STRUCTURE =	4.2	INTERCONNECT HARNESS =	25.8
BOX COVER =	23.7	BOX HINGE =	.5	COVER LATCH =	5.8
CONTAINER =	51.8	MAST TIP FITTING =	2.7	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR.LATCH =	.4	CONT BX DEPLOY DEVICE =	2.9
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.9		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 25.0 KW   ARRAY WIDTH = 8.00 M

ARRAY LENGTH = 31.50 M   ASPECT RATIO = 3.94   BLANKET AREA = .39063+06 IN=SQ   BLANKET WEIGHT = 520.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.014	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.025	.035	.052	.070	.087	.105
***** BENDING FREQUENCY HZ *****	.014	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	314.9	322.0	335.7	349.5	363.4	377.5
ARRAY WEIGHT (LB)	692.7	708.5	738.5	768.8	799.5	830.5
CENTER OF GRAVITY (IN)	557.2	551.9	542.6	533.9	525.7	517.9
BLANKET TENSION (LB)	3.00	5.53	12.45	22.13	34.58	49.79
MOMENT OF INERTIA I1	.3332+09	.3376+09	.3460+09	.3545+09	.3630+09	.3715+09
MOMENT OF INERTIA I2	.5410+07	.5416+07	.5430+07	.5449+07	.5474+07	.5504+07
SPECIFIC POWER (KW/KG)	.079	.078	.074	.072	.069	.066
SPECIFIC WEIGHT (KG/KW)	12.6	12.9	13.4	14.0	14.5	15.1
* BOOM PROPERTIES *						
DIAMETER (IN)	10.53	12.28	15.07	17.44	19.53	21.44
EI (LB=IN=SQ)	.57536+07	.10653+08	.24155+08	.43273+08	.68137+08	.98874+08
ROOT SPRING (LB=IN/RAD)	.8564+05	.1359+06	.2512+06	.3889+06	.5467+06	.7228+06
BUCKLING CAPABILITY RATIO	8.68	8.43	7.97	7.52	7.07	6.64
STRENGTH CAPABILITY RATIO	1.01	1.58	2.86	4.32	5.93	7.66
* CANNISTER PROPERTIES *						
HEIGHT (IN)	44.66	47.55	52.16	56.06	59.52	62.66
DIAMETER (IN)	12.43	14.49	17.79	20.58	23.05	25.30
* WEIGHTS (LB) *						
ARRAY	692.7	708.5	738.5	768.8	799.5	830.5
BOOM	23.7	32.2	48.5	65.0	81.5	98.2
CANNISTER	21.5	28.6	41.7	54.8	67.9	81.0
FULL TENSIONER	1.0	1.2	1.8	2.5	3.5	4.6
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.0	1.1	1.2

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	520.0	SUPPORT STRUCTURE =	4.2	INTERCONNECT HARNESS =	25.8
BOX COVER =	23.7	BOX HINGE =	.6	COVER LATCH =	5.6
CONTAINER =	52.9	MAST TIP FITTING =	2.7	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	2.9
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	3.8		

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 30.0 KW   ARRAY WIDTH = 5.00 M

ARRAY LENGTH = 60.48 M   ASPECT RATIO = 12.10   BLANKET AREA = .46875+06 IN*SQ   BLANKET WEIGHT = 624.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.049	.100	.153	.208	.265	.323
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	411.8	473.7	537.6	603.6	672.0	742.9
ARRAY WEIGHT (LB)	905.9	1042.2	1182.7	1328.0	1478.5	1634.3
CENTER OF GRAVITY (IN)	1061.9	1028.9	1003.1	982.1	964.6	949.6
BLANKET TENSION (LB)	3.19	12.75	28.68	50.98	79.66	114.72
MOMENT OF INERTIA I1	.1590+10	.1768+10	.1953+10	.2145+10	.2343+10	.2548+10
MOMENT OF INERTIA I2	.2546+07	.2553+07	.2566+07	.2583+07	.2605+07	.2632+07
SPECIFIC POWER (KW/KG)	.073	.063	.056	.050	.045	.040
SPECIFIC WEIGHT (KG/KW)	13.7	15.8	17.9	20.1	22.4	24.8
* BOOM PROPERTIES *						
DIAMETER (IN)	14.90	21.26	26.28	30.61	34.53	38.17
EI (LB*IN*SQ)	.23070+08	.95649+08	.22307+09	.41102+09	.66561+09	.99333+09
ROOT SPRING (LB*IN/RAD)	.2427+06	.7051+06	.1331+07	.2104+07	.3021+07	.4079+07
BUCKLING CAPABILITY RATIO	9.74	9.78	9.81	9.79	9.70	9.54
STRENGTH CAPABILITY RATIO	1.15	3.00	5.11	7.36	9.66	11.98
* CANNISTER PROPERTIES *						
HEIGHT (IN)	76.97	87.47	95.74	102.90	109.37	115.37
DIAMETER (IN)	17.58	25.09	31.00	36.12	40.75	45.04
* WEIGHTS (LB) *						
ARRAY	905.9	1042.2	1182.7	1328.0	1478.5	1634.3
BOOM	91.1	185.5	283.2	384.0	489.2	597.6
CANNISTER	45.9	87.0	128.5	170.8	214.2	258.9
FULL TENSIONER	1.0	1.8	3.0	4.7	6.8	9.5
INTERMEDIATE TENSIONER	.9	1.0	1.1	1.2	1.3	1.5

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	624.0	SUPPORT STRUCTURE =	4.6	INTERCONNECT HARNESS =	31.0
BOX COVER =	28.4	BOX HINGE =	.1	COVER LATCH =	10.0
CONTAINER =	53.0	MAST TIP FITTING =	2.9	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	3.5
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	6.1		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 30.0 KW   ARRAY WIDTH = 5.50 M

ARRAY LENGTH = 54.99 M   ASPECT RATIO = 10.00   BLANKET AREA = .46875+06 IN-SQ   BLANKET WEIGHT = 624.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.042	.083	.126	.170	.216	.262
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	400.8	449.7	500.6	552.9	606.7	662.1
ARRAY WEIGHT (LB)	881.9	989.4	1101.4	1216.4	1334.8	1456.5
CENTER OF GRAVITY (IN)	969.4	941.5	918.4	899.1	882.5	868.0
BLANKET TENSION (LB)	3.00	11.59	26.07	46.35	72.42	104.29
MOMENT OF INERTIA I1	.1285+10	.1398+10	.1517+10	.1638+10	.1763+10	.1892+10
MOMENT OF INERTIA I2	.3068+07	.3077+07	.3091+07	.3110+07	.3134+07	.3164+07
SPECIFIC POWER (KW/KG)	.075	.067	.060	.054	.049	.045
SPECIFIC WEIGHT (KG/KW)	13.4	15.0	16.7	18.4	20.2	22.1
* BOOM PROPERTIES *						
DIAMETER (IN)	13.97	19.72	24.32	28.29	31.85	35.13
EI (LB-IN-SQ)	.17823+08	.70778+08	.16382+09	.29957+09	.48148+09	.71316+09
ROOT SPRING (LB-IN/RAD)	.2000+06	.5625+06	.1056+07	.1660+07	.2370+07	.3181+07
BUCKLING CAPABILITY RATIO	9.60	9.53	9.45	9.33	9.14	8.89
STRENGTH CAPABILITY RATIO	1.07	2.75	4.76	6.92	9.17	11.47
* CANNISTER PROPERTIES *						
HEIGHT (IN)	70.67	80.16	87.76	94.30	100.17	105.60
DIAMETER (IN)	16.48	23.27	28.70	33.38	37.58	41.46
* WEIGHTS (LB) *						
ARRAY	881.9	989.4	1101.4	1216.4	1334.8	1456.5
BOOM	72.8	145.0	220.6	298.4	378.3	460.4
CANNISTER	40.1	74.6	109.8	145.5	181.9	219.0
FULL TENSIONER	1.0	1.7	2.8	4.3	6.3	8.7
INTERMEDIATE TENSIONER	.9	1.0	1.1	1.1	1.3	1.4

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	624.0	SUPPORT STRUCTURE =	4.6	INTERCONNECT HARNESS =	31.0
BOX COVER =	28.4	BOX HINGE =	.1	COVER LATCH =	9.4
CONTAINER =	54.2	MAST TIP FITTING =	2.9	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	3.5
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.6		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 30.0 KW ARRAY WIDTH = 6.00 M

ARRAY LENGTH = 50.40 M ASPECT RATIO = 8.40 BLANKET AREA = .46875+06 IN-SQ BLANKET WEIGHT = 624.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.037	.070	.106	.142	.180	.218
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	393.9	432.3	473.9	516.4	559.9	604.5
ARRAY WEIGHT (LB)	866.7	951.0	1042.5	1136.0	1231.8	1329.9
CENTER OF GRAVITY (IN)	890.9	868.0	847.6	829.9	814.5	800.8
BLANKET TENSION (LB)	3.00	10.62	23.90	42.49	66.39	95.60
MOMENT OF INERTIA I1	.1065+10	.1137+10	.1216+10	.1296+10	.1379+10	.1463+10
MOMENT OF INERTIA I2	.3642+07	.3651+07	.3666+07	.3687+07	.3713+07	.3746+07
SPECIFIC POWER (KW/KG)	.076	.069	.063	.058	.054	.050
SPECIFIC WEIGHT (KG/KW)	13.1	14.4	15.8	17.2	18.7	20.1
* BOOM PROPERTIES *						
DIAMETER (IN)	13.36	18.42	22.69	26.35	29.63	32.64
EI (LB-IN-SQ)	.14907+08	.53918+08	.12411+09	.22571+09	.36077+09	.53144+09
ROOT SPRING (LB-IN/RAD)	.1749+06	.4587+06	.8572+06	.1342+07	.1908+07	.2552+07
BUCKLING CAPABILITY RATIO	9.47	9.32	9.16	8.95	8.69	8.38
STRENGTH CAPABILITY RATIO	1.03	2.53	4.42	6.49	8.67	10.92
* CANNISTER PROPERTIES *						
HEIGHT (IN)	65.70	74.06	81.10	87.14	92.55	97.52
DIAMETER (IN)	15.76	21.74	26.78	31.10	34.96	38.52
* WEIGHTS (LB) *						
ARRAY	866.7	951.0	1042.5	1136.0	1231.8	1329.9
BOOM	61.0	116.0	176.0	237.4	300.1	364.3
CANNISTER	36.3	64.9	95.4	126.1	157.2	188.8
FULL TENSIONER	1.0	1.7	2.7	4.0	5.8	8.0
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.1	1.2	1.4

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	624.0	SUPPORT STRUCTURE =	4.6	INTERCONNECT HARNESS =	31.0
BOX COVER =	28.4	BOX HINGE =	.2	COVER LATCH =	8.9
CONTAINER =	55.3	MAST TIP FITTING =	2.9	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	3.5
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.3		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 30.0 KW   ARRAY WIDTH = 6.50 M

ARRAY LENGTH = 46.53 M   ASPECT RATIO = 7.16   BLANKET AREA = .46875+06 IN-SQ   BLANKET WEIGHT = 624.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.033	.060	.090	.121	.153	.185
***** BENDING FREQUENCY HZ *****	.011	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	388.6	419.2	453.9	489.2	525.2	562.0
ARRAY WEIGHT (LB)	854.9	922.2	998.5	1076.2	1155.5	1236.4
CENTER OF GRAVITY (IN)	824.0	805.2	787.1	771.2	757.0	744.3
BLANKET TENSION (LB)	3.00	9.80	22.06	39.22	61.28	88.24
MOMENT OF INERTIA I1	.8969+09	.9448+09	.9992+09	.1055+10	.1111+10	.1169+10
MOMENT OF INERTIA I2	.4266+07	.4276+07	.4292+07	.4314+07	.4343+07	.4378+07
SPECIFIC POWER (KW/KG)	.077	.072	.066	.061	.057	.053
SPECIFIC WEIGHT (KG/KW)	13.0	14.0	15.1	16.3	17.5	18.7
* BOOM PROPERTIES *						
DIAMETER (IN)	12.82	17.31	21.30	24.72	27.76	30.55
EI (LB-IN-SQ)	.12657+08	.42060+08	.96413+08	.17462+09	.27797+09	.40779+09
ROOT SPRING (LB-IN/RAD)	.1547+06	.3807+06	.7093+06	.1107+07	.1569+07	.2092+07
BUCKLING CAPABILITY RATIO	9.35	9.15	8.91	8.64	8.32	7.97
STRENGTH CAPABILITY RATIO	1.00	2.34	4.11	6.08	8.18	10.36
* CANNISTER PROPERTIES *						
HEIGHT (IN)	61.46	68.87	75.45	81.08	86.10	90.71
DIAMETER (IN)	15.13	20.43	25.14	29.16	32.76	36.05
* WEIGHTS (LB) *						
ARRAY	854.9	922.2	998.5	1076.2	1155.5	1236.4
BOOM	51.9	94.6	143.2	192.8	243.2	294.6
CANNISTER	33.2	57.2	83.9	110.7	137.8	165.2
FULL TENSIONER	1.0	1.6	2.5	3.8	5.5	7.5
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.1	1.2	1.3

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	624.0	SUPPORT STRUCTURE =	4.6	INTERCONNECT HARNESS =	31.0
BOX COVER =	28.4	BOX HINGE =	.3	COVER LATCH =	8.5
CONTAINER =	56.4	MAST TIP FITTING =	2.9	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	3.5
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.0		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 30.0 KW ARRAY WIDTH = 7.00 M

ARRAY LENGTH = 43.20 M ASPECT RATIO = 6.17 BLANKET AREA = .46875+06 IN=SQ BLANKET WEIGHT = 624.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.030	.052	.078	.105	.132	.160
***** BENDING FREQUENCY HZ *****	.011	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	384.4	409.2	438.6	468.4	498.8	529.8
ARRAY WEIGHT (LB)	845.7	900.2	964.9	1030.6	1097.4	1165.5
CENTER OF GRAVITY (IN)	766.3	750.9	734.8	720.5	707.6	695.8
BLANKET TENSION (LB)	3.00	9.10	20.48	36.42	56.90	81.94
MOMENT OF INERTIA I1	.7664+09	.7989+09	.8377+09	.8770+09	.9169+09	.9575+09
MOMENT OF INERTIA I2	.4941+07	.4952+07	.4969+07	.4993+07	.5024+07	.5062+07
SPECIFIC POWER (KW/KG)	.078	.073	.068	.064	.060	.057
SPECIFIC WEIGHT (KG/KW)	12.8	13.6	14.6	15.6	16.6	17.7
* BOOM PROPERTIES *						
DIAMETER (IN)	12.35	16.35	20.11	23.31	26.16	28.76
EI (LB=IN=SQ)	.10882+08	.33464+08	.76469+08	.13806+09	.21909+09	.32040+09
ROOT SPRING (LB=IN/RAD)	.1381+06	.3207+06	.5961+06	.9285+06	.1313+07	.1746+07
BUCKLING CAPABILITY RATIO	9.23	8.99	8.69	8.37	8.01	7.62
STRENGTH CAPABILITY RATIO	.97	2.16	3.83	5.70	7.71	9.81
* CANNISTER PROPERTIES *						
HEIGHT (IN)	57.79	64.40	70.59	75.87	80.58	84.88
DIAMETER (IN)	14.57	19.30	23.72	27.50	30.87	33.94
* WEIGHTS (LB) *						
ARRAY	845.7	900.2	964.9	1030.6	1097.4	1165.5
BOOM	44.7	78.4	118.4	159.1	200.5	242.4
CANNISTER	30.5	50.8	74.5	98.2	122.1	146.2
FULL TENSIONER	1.0	1.5	2.4	3.6	5.1	7.0
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.1	1.2	1.3

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	624.0	SUPPORT STRUCTURE =	4.6	INTERCONNECT HARNESS =	31.0
BOX COVER =	28.4	BOX HINGE =	.5	COVER LATCH =	8.1
CONTAINER =	57.6	MAST TIP FITTING =	2.9	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	3.5
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.7		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 30.0 KW   ARRAY WIDTH = 7.50 M

ARRAY LENGTH = 40.32 M   ASPECT RATIO = 5.38   BLANKET AREA = .46875+06 IN=SQ   BLANKET WEIGHT = 624.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.027	.046	.069	.092	.116	.140
***** BENDING FREQUENCY HZ *****	.011	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	381.1	401.4	426.7	452.3	478.3	504.7
ARRAY WEIGHT (LB)	838.3	883.1	938.7	995.0	1052.2	1110.3
CENTER OF GRAVITY (IN)	716.1	703.3	689.1	676.3	664.5	653.6
BLANKET TENSION (LB)	3.00	8.50	19.12	33.99	53.11	76.48
MOMENT OF INERTIA I1	.6628+09	.6854+09	.7136+09	.7422+09	.7712+09	.8005+09
MOMENT OF INERTIA I2	.5668+07	.5679+07	.5697+07	.5723+07	.5756+07	.5797+07
SPECIFIC POWER (KW/KG)	.079	.075	.070	.066	.063	.059
SPECIFIC WEIGHT (KG/KW)	12.7	13.4	14.2	15.1	15.9	16.8
* BOOM PROPERTIES *						
DIAMETER (IN)	11.92	15.51	19.06	22.08	24.76	27.21
EI (LB=IN=SQ)	.94581+07	.27075+08	.61717+08	.11116+09	.17596+09	.25670+09
ROOT SPRING (LB=IN/RAD)	.1243+06	.2736+06	.5076+06	.7892+06	.1114+07	.1478+07
BUCKLING CAPABILITY RATIO	9.12	8.84	8.50	8.12	7.73	7.31
STRENGTH CAPABILITY RATIO	.94	2.01	3.58	5.35	7.26	9.29
* CANNISTER PROPERTIES *						
HEIGHT (IN)	54.60	60.51	66.37	71.35	75.78	79.83
DIAMETER (IN)	14.07	18.30	22.49	26.05	29.22	32.11
* WEIGHTS (LB) *						
ARRAY	838.3	883.1	938.7	995.0	1052.2	1110.3
BOOM	38.9	65.8	99.3	133.3	167.7	202.5
CANNISTER	28.3	45.6	66.8	88.0	109.3	130.7
FULL TENSIONER	1.0	1.5	2.3	3.4	4.8	6.6
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.1	1.2	1.3

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	624.0	SUPPORT STRUCTURE =	4.6	INTERCONNECT HARNESS =	31.0
BOX COVER =	28.4	BOX HINGE =	.6	COVER LATCH =	7.8
CONTAINER =	58.7	MAST TIP FITTING =	2.9	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CP LATCH =	.4	CONT BX DEPLOY DEVICE =	3.5
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.5		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 30.0 KW   ARRAY WIDTH = 8.00 M

ARRAY LENGTH = 37.80 M   ASPECT RATIO = 4.73   BLANKET AREA = .46875+06 IN-SQ   BLANKET WEIGHT = 624.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.012	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.025	.041	.061	.082	.103	.124
***** BENDING FREQUENCY HZ *****	.012	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	378.4	395.3	417.2	439.4	462.0	484.9
ARRAY WEIGHT (LB)	832.5	869.6	917.9	966.8	1016.4	1066.7
CENTER OF GRAVITY (IN)	671.9	661.2	648.7	637.2	626.5	616.5
BLANKET TENSION (LB)	3.00	7.97	17.92	31.87	49.79	71.70
MOMENT OF INERTIA I1	.5790+09	.5951+09	.6161+09	.6373+09	.6588+09	.6805+09
MOMENT OF INERTIA I2	.6445+07	.6457+07	.6476+07	.6504+07	.6539+07	.6582+07
SPECIFIC POWER (KW/KG)	.079	.076	.072	.068	.065	.062
SPECIFIC WEIGHT (KG/KW)	12.6	13.2	13.9	14.6	15.4	16.2
* BOOM PROPERTIES *						
DIAMETER (IN)	11.54	14.76	18.13	20.99	23.54	25.85
EI (LB-IN-SQ)	.82973+07	.22223+08	.50558+08	.90882+08	.14359+09	.20907+09
ROOT SPRING (LB-IN/RAD)	.1127+06	.2360+06	.4371+06	.6786+06	.9562+06	.1267+07
BUCKLING CAPABILITY RATIO	9.01	8.70	8.31	7.91	7.48	7.05
STRENGTH CAPABILITY RATIO	.92	1.87	3.35	5.02	6.85	8.79
* CANNISTER PROPERTIES *						
HEIGHT (IN)	51.78	57.10	62.66	67.38	71.58	75.40
DIAMETER (IN)	13.62	17.42	21.39	24.77	27.77	30.51
* WEIGHTS (LB) *						
ARRAY	832.5	869.6	917.9	966.8	1016.4	1066.7
BOOM	34.1	55.9	84.3	113.0	142.0	171.4
CANNISTER	26.3	41.2	60.3	79.4	98.6	117.8
FULL TENSIONER	1.0	1.5	2.2	3.2	4.6	6.2
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.1	1.2	1.3

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	624.0	SUPPORT STRUCTURE =	4.6	INTERCONNECT HARNESS =	31.0
BOX COVER =	28.4	BOX HINGE =	.7	COVER LATCH =	7.5
CONTAINER =	59.9	MAST TIP FITTING =	2.9	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	3.5
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.3		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 35.0 KW   ARRAY WIDTH = 6.00 M

ARRAY LENGTH = 58.80 M   ASPECT RATIO = 9.80   BLANKET AREA = .54688+06 IN**SQ   BLANKET WEIGHT = 728.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.040	.081	.124	.168	.213	.259
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	470.0	532.4	596.4	662.4	730.5	800.6
ARRAY WEIGHT (LB)	1034.0	1171.2	1312.1	1457.3	1607.0	1761.4
CENTER OF GRAVITY (IN)	1038.0	1007.8	983.5	963.3	946.1	931.2
BLANKET TENSION (LB)	3.61	14.46	32.53	57.83	90.36	130.12
MOMENT OF INERTIA I1	.1725+10	.1893+10	.2067+10	.2246+10	.2431+10	.2621+10
MOMENT OF INERTIA I2	.4236+07	.4249+07	.4269+07	.4297+07	.4333+07	.4377+07
SPECIFIC POWER (KW/KG)	.074	.066	.059	.053	.048	.044
SPECIFIC WEIGHT (KG/KW)	13.4	15.2	17.0	18.9	20.9	22.9
* BOOM PROPERTIES *						
DIAMETER (IN)	15.14	21.58	26.63	30.99	34.92	38.55
EI (LB-IN-SQ)	.24598+08	.10149+09	.23553+09	.43186+09	.69597+09	.10336+10
ROOT SPRING (LB-IN/RAD)	.2546+06	.7371+06	.1386+07	.2184+07	.3124+07	.4202+07
BUCKLING CAPABILITY RATIO	9.64	9.60	9.55	9.43	9.25	8.98
STRENGTH CAPABILITY RATIO	1.08	2.85	4.90	7.09	9.37	11.68
* CANNISTER PROPERTIES *						
HEIGHT (IN)	75.92	86.54	94.88	102.07	108.55	114.54
DIAMETER (IN)	17.87	25.46	31.43	36.57	41.21	45.49
* WEIGHTS (LB) *						
ARRAY	1034.0	1171.2	1312.1	1457.3	1607.0	1761.4
BOOM	91.4	185.7	282.9	383.1	486.4	592.7
CANNISTER	47.0	89.0	131.3	174.2	218.1	263.0
FULL TENSIONER	1.1	1.9	3.3	5.2	7.6	10.6
INTERMEDIATE TENSIONER	.9	1.0	1.1	1.2	1.3	1.5

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	728.0	SUPPORT STRUCTURE =	5.1	INTERCONNECT HARNESS =	36.2
BOX COVER =	33.2	BOX HINGE =	.3	COVER LATCH =	12.4
CONTAINER =	62.3	MAST TIP FITTING =	3.0	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	4.1
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.9		

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE LMSC FOLDOUT POWER/WING = 35.0 KW ARRAY WIDTH = 6.50 M

ARRAY LENGTH = 54.28 M ASPECT RATIO = 8.35 BLANKET AREA = .54688+06 IN=SQ BLANKET WEIGHT = 728.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.034	.069	.105	.142	.180	.219
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	459.9	511.9	564.9	619.3	675.1	732.4
ARRAY WEIGHT (LB)	1011.8	1126.1	1242.8	1362.5	1485.3	1611.4
CENTER OF GRAVITY (IN)	961.7	935.2	913.3	894.6	878.3	864.1
BLANKET TENSION (LB)	3.34	13.35	30.03	53.38	83.41	120.11
MOMENT OF INERTIA I1	.1444+10	.1561+10	.1680+10	.1803+10	.1929+10	.2057+10
MOMENT OF INERTIA I2	.4960+07	.4974+07	.4996+07	.5026+07	.5065+07	.5113+07
SPECIFIC POWER (KW/KG)	.076	.068	.062	.057	.052	.048
SPECIFIC WEIGHT (KG/KW)	13.1	14.6	16.1	17.7	19.3	20.9
* BOOM PROPERTIES *						
DIAMETER (IN)	14.24	20.27	24.98	29.02	32.66	36.00
EI (LB-IN-SQ)	.19239+08	.78932+08	.18215+09	.33214+09	.53227+09	.78611+09
ROOT SPRING (LB=IN/RAD)	.2118+06	.6105+06	.1143+07	.1794+07	.2555+07	.3422+07
BUCKLING CAPABILITY RATIO	9.53	9.40	9.26	9.07	8.81	8.49
STRENGTH CAPABILITY RATIO	.99	2.64	4.59	6.71	8.93	11.21
* CANNISTER PROPERTIES *						
HEIGHT (IN)	70.51	80.45	88.23	94.91	100.90	106.42
DIAMETER (IN)	16.80	23.91	29.47	34.25	38.53	42.48
* WEIGHTS (LB) *						
ARRAY	1011.8	1126.1	1242.8	1362.5	1485.3	1611.4
BOOM	74.6	151.2	229.7	310.1	392.6	477.1
CANNISTER	41.4	78.3	115.2	152.5	190.5	229.1
FULL TENSIONER	1.1	1.9	3.1	4.9	7.1	9.9
INTERMEDIATE TENSIONER	.9	1.0	1.1	1.2	1.3	1.5

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	728.0	SUPPORT STRUCTURE =	5.1	INTERCONNECT HARNESS =	36.2
BOX COVER =	33.2	BOX HINGE =	.4	COVER LATCH =	11.7
CONTAINER =	63.4	MAST TIP FITTING =	3.0	MID TENSION MECHANISM =	.03
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	4.1
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.6		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 35.0 KW   ARRAY WIDTH = 7.00 M

ARRAY LENGTH = 50.40 M   ASPECT RATIO = 7.20   BLANKET AREA = .54688+06 IN*SQ   BLANKET WEIGHT = 728.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.030	.060	.091	.122	.155	.187
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	452.2	496.2	540.9	586.6	633.3	681.1
ARRAY WEIGHT (LB)	994.8	1091.6	1190.0	1290.5	1393.2	1498.3
CENTER OF GRAVITY (IN)	895.6	872.4	852.7	835.6	820.4	806.9
BLANKET TENSION (LB)	3.10	12.39	27.88	49.57	77.45	111.53
MOMENT OF INERTIA I1	.1228+10	.1311+10	.1396+10	.1483+10	.1571+10	.1661+10
MOMENT OF INERTIA I2	.5743+07	.5758+07	.5782+07	.5814+07	.5857+07	.5908+07
SPECIFIC POWER (KW/KG)	.077	.071	.065	.060	.055	.051
SPECIFIC WEIGHT (KG/KW)	12.9	14.2	15.5	16.8	18.1	19.5
* BOOM PROPERTIES *						
DIAMETER (IN)	13.45	19.13	23.55	27.34	30.73	33.84
EI (LB-IN-SQ)	.15338+08	.62658+08	.14398+09	.26141+09	.41714+09	.61346+09
ROOT SPRING (LB-IN/RAD)	.1787+06	.5134+06	.9582+06	.1499+07	.2128+07	.2842+07
BUCKLING CAPABILITY RATIO	9.43	9.23	9.02	8.76	8.44	8.08
STRENGTH CAPABILITY RATIO	.91	2.46	4.30	6.34	8.49	10.71
* CANNISTER PROPERTIES *						
HEIGHT (IN)	65.86	75.22	82.52	88.76	94.35	99.49
DIAMETER (IN)	15.88	22.57	27.79	32.26	36.26	39.93
* WEIGHTS (LB) *						
ARRAY	994.8	1091.6	1190.0	1290.5	1393.2	1498.3
BOOM	61.9	125.1	189.6	255.5	322.7	391.4
CANNISTER	36.8	69.5	102.2	135.1	168.4	202.1
FULL TENSIONER	1.0	1.8	3.0	4.6	6.7	9.2
INTERMEDIATE TENSIONER	.9	1.0	1.1	1.2	1.3	1.4

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	728.0	SUPPORT STRUCTURE =	5.1	INTERCONNECT HARNESS =	36.2
BOX COVER =	33.2	BOX HINGE =	.5	COVER LATCH =	11.1
CONTAINER =	64.5	MAST TIP FITTING =	3.0	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	4.1
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.3		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 35.0 KW ARRAY WIDTH = 7.50 M

ARRAY LENGTH = 47.04 M ASPECT RATIO = 6.27 BLANKET AREA = .54688+06 IN=SQ BLANKET WEIGHT = 728.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.027	.053	.080	.107	.135	.163
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	446.9	483.9	522.2	561.1	600.9	641.4
ARRAY WEIGHT (LB)	983.1	1064.6	1148.8	1234.5	1321.9	1411.1
CENTER OF GRAVITY (IN)	837.5	817.5	799.9	784.2	770.2	757.5
BLANKET TENSION (LB)	3.00	11.57	26.02	46.26	72.29	104.09
MOMENT OF INERTIA I1	.1060+10	.1119+10	.1181+10	.1244+10	.1308+10	.1373+10
MOMENT OF INERTIA I2	.6585+07	.6601+07	.6626+07	.6662+07	.6707+07	.6762+07
SPECIFIC POWER (KW/KG)	.078	.072	.067	.062	.058	.055
SPECIFIC WEIGHT (KG/KW)	12.8	13.8	14.9	16.0	17.2	18.3
* BOOM PROPERTIES *						
DIAMETER (IN)	12.88	18.13	22.31	25.87	29.06	31.97
EI (LB-IN-SQ)	.12899+08	.50604+08	.11590+09	.20972+09	.33355+09	.48889+09
ROOT SPRING (LB-IN/RAD)	.1569+06	.4374+06	.8143+06	.1270+07	.1799+07	.2397+07
BUCKLING CAPABILITY RATIO	9.33	9.08	8.81	8.49	8.13	7.73
STRENGTH CAPABILITY RATIO	.87	2.29	4.04	5.98	8.06	10.22
* CANNISTER PROPERTIES *						
HEIGHT (IN)	62.01	70.67	77.55	83.44	88.69	93.50
DIAMETER (IN)	15.20	21.40	26.32	30.53	34.29	37.72
* WEIGHTS (LB) *						
ARRAY	983.1	1064.6	1148.8	1234.5	1321.9	1411.1
BOOM	53.0	104.9	158.8	213.6	269.4	326.1
CANNISTER	33.5	62.3	91.5	120.8	150.3	180.2
FULL TENSIONER	1.0	1.7	2.8	4.3	6.3	8.7
INTERMEDIATE TENSIONER	.9	1.0	1.1	1.1	1.3	1.4

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	728.0	SUPPORT STRUCTURE =	5.1	INTERCONNECT HARNESS =	36.2
BOX COVER =	33.2	BOX HINGE =	.7	COVER LATCH =	10.6
CONTAINER =	65.7	MAST TIP FITTING =	3.0	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	4.1
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.0		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 35.0 KW   ARRAY WIDTH = 8.00 M

ARRAY LENGTH = 44.10 M   ASPECT RATIO = 5.51   BLANKET AREA = .54688+06 IN*SQ   BLANKET WEIGHT = 728.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.024	.047	.070	.095	.119	.144
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	443.2	474.2	507.4	541.0	575.3	610.1
ARRAY WEIGHT (LB)	975.0	1043.3	1116.2	1190.2	1265.6	1342.3
CENTER OF GRAVITY (IN)	786.1	769.1	753.3	739.0	726.1	714.3
BLANKET TENSION (LB)	3.00	10.84	24.40	43.37	67.77	97.59
MOMENT OF INERTIA I1	.9250+09	.9678+09	.1014+10	.1060+10	.1107+10	.1155+10
MOMENT OF INERTIA I2	.7487+07	.7504+07	.7530+07	.7568+07	.7616+07	.7675+07
SPECIFIC POWER (KW/KG)	.079	.074	.069	.065	.061	.057
SPECIFIC WEIGHT (KG/KW)	12.7	13.5	14.5	15.5	16.4	17.4
* BOOM PROPERTIES *						
DIAMETER (IN)	12.47	17.25	21.21	24.59	27.59	30.34
EI (LB*IN*SQ)	.11313+08	.41477+08	.94742+08	.17099+09	.27123+09	.39651+09
ROOT SPRING (LB*IN/RAD)	.1422+06	.3768+06	.7001+06	.1090+07	.1541+07	.2048+07
BUCKLING CAPABILITY RATIO	9.24	8.94	8.62	8.26	7.86	7.43
STRENGTH CAPABILITY RATIO	.85	2.14	3.80	5.65	7.64	9.74
* CANNISTER PROPERTIES *						
HEIGHT (IN)	58.77	66.67	73.20	78.77	83.73	88.26
DIAMETER (IN)	14.71	20.36	25.03	29.01	32.56	35.80
* WEIGHTS (LB) *						
ARRAY	975.0	1043.3	1116.2	1190.2	1265.6	1342.3
BOOM	46.5	89.0	134.6	180.8	227.7	275.3
CANNISTER	31.2	56.3	82.6	108.9	135.4	162.1
FULL TENSIONER	1.0	1.7	2.7	4.1	5.9	8.2
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.1	1.2	1.4

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	728.0	SUPPORT STRUCTURE =	5.1	INTERCONNECT HARNESS =	36.2
BOX COVER =	33.2	BOX HINGE =	.8	COVER LATCH =	10.2
CONTAINER =	66.8	MAST TIP FITTING =	3.0	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	4.1
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.8		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 35.0 KW   ARRAY WIDTH = 8.50 M

ARRAY LENGTH = 41.51 M   ASPECT RATIO = 4.88   BLANKET AREA = .54688+06 IN=SQ   BLANKET WEIGHT = 728.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.023	.042	.063	.085	.106	.128
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	440.1	466.4	495.4	524.8	554.7	585.1
ARRAY WEIGHT (LB)	968.3	1026.2	1089.9	1154.6	1220.3	1287.1
CENTER OF GRAVITY (IN)	740.5	726.0	711.8	698.9	687.0	676.0
BLANKET TENSION (LB)	3.00	10.21	22.96	40.82	63.78	91.85
MOMENT OF INERTIA I1	.8146+09	.8460+09	.8807+09	.9159+09	.9515+09	.9876+09
MOMENT OF INERTIA I2	.8447+07	.8465+07	.8494+07	.8533+07	.8584+07	.8647+07
SPECIFIC POWER (KW/KG)	.080	.075	.071	.067	.063	.060
SPECIFIC WEIGHT (KG/KW)	12.6	13.3	14.2	15.0	15.8	16.7
* BOOM PROPERTIES *						
DIAMETER (IN)	12.09	16.47	20.24	23.44	26.30	28.90
EI (LB-IN-SQ)	.10003+08	.34434+08	.78486+08	.14135+09	.22374+09	.32639+09
ROOT SPRING (LB-IN/RAD)	.1297+06	.3277+06	.6079+06	.9450+06	.1334+07	.1770+07
BUCKLING CAPABILITY RATIO	9.14	8.81	8.44	8.04	7.61	7.17
STRENGTH CAPABILITY RATIO	.82	2.01	3.57	5.34	7.25	9.27
* CANNISTER PROPERTIES *						
HEIGHT (IN)	55.90	63.13	69.34	74.63	79.34	83.63
DIAMETER (IN)	14.27	19.43	23.88	27.66	31.03	34.10
* WEIGHTS (LB) *						
ARRAY	968.3	1026.2	1089.9	1154.6	1220.3	1287.1
BOOM	41.2	76.4	115.3	154.7	194.7	235.1
CANNISTER	29.2	51.2	75.0	98.9	122.8	146.9
FULL TENSIONER	1.0	1.6	2.6	3.9	5.6	7.7
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.1	1.2	1.4

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	728.0	SUPPORT STRUCTURE =	5.1	INTERCONNECT HARNESS =	36.2
BOX COVER =	33.2	BOX HINGE =	1.0	COVER LATCH =	9.8
CONTAINER =	67.9	MAST TIP FITTING =	3.0	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	4.1
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.6		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 35.0 KW ARRAY WIDTH = 9.00 M

ARRAY LENGTH = 39.20 M ASPECT RATIO = 4.36 BLANKET AREA = .54688+06 IN-SQ BLANKET WEIGHT = 728.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.021	.038	.057	.076	.096	.116
***** BENDING FREQUENCY HZ *****	.011	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	437.6	460.1	485.7	511.6	537.9	564.6
ARRAY WEIGHT (LB)	962.8	1012.2	1068.5	1125.6	1183.5	1242.2
CENTER OF GRAVITY (IN)	699.8	687.4	674.6	662.9	652.0	641.8
BLANKET TENSION (LB)	3.00	9.64	21.69	38.55	60.24	86.74
MOMENT OF INERTIA I1	.7231+09	.7464+09	.7732+09	.8002+09	.8275+09	.8552+09
MOMENT OF INERTIA I2	.9468+07	.9486+07	.9516+07	.9559+07	.9613+07	.9679+07
SPECIFIC POWER (KW/KG)	.080	.076	.072	.068	.065	.062
SPECIFIC WEIGHT (KG/KW)	12.5	13.1	13.9	14.6	15.4	16.1
* BOOM PROPERTIES *						
DIAMETER (IN)	11.75	15.76	19.36	22.42	25.14	27.61
EI (LB-IN-SQ)	.89087+07	.28908+08	.65777+08	.11826+09	.18687+09	.27213+09
ROOT SPRING (LB-IN/RAD)	.1189+06	.2874+06	.5325+06	.8267+06	.1165+07	.1545+07
BUCKLING CAPABILITY RATIO	9.05	8.69	8.28	7.84	7.39	6.93
STRENGTH CAPABILITY RATIO	.80	1.88	3.37	5.05	6.88	8.83
* CANNISTER PROPERTIES *						
HEIGHT (IN)	53.34	59.97	65.90	70.95	75.43	79.52
DIAMETER (IN)	13.86	18.60	22.85	26.46	29.66	32.58
* WEIGHTS (LB) *						
ARRAY	962.8	1012.2	1068.5	1125.6	1183.5	1242.2
BOOM	36.7	66.1	99.7	133.7	168.0	202.7
CANNISTER	27.4	46.8	68.6	90.3	112.1	134.0
FULL TENSIONER	1.0	1.6	2.5	3.8	5.4	7.4
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.1	1.2	1.3

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	728.0	SUPPORT STRUCTURE =	5.1	INTERCONNECT HARNESS =	36.2
BOX COVER =	33.2	BOX HINGE =	1.2	COVER LATCH =	9.4
CONTAINER =	69.1	MAST TIP FITTING =	3.0	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	4.1
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.4		

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE LMSC FOLDOUT POWER/WING = 40.0 KW ARRAY WIDTH = 7.00 M

ARRAY LENGTH = 57.60 M ASPECT RATIO = 8.23 BLANKET AREA = .62500+06 IN-SQ BLANKET WEIGHT = 832.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.034	.069	.104	.141	.178	.217
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	528.9	592.3	657.2	723.8	792.4	862.9
ARRAY WEIGHT (LB)	1163.6	1303.0	1445.8	1592.5	1743.3	1898.5
CENTER OF GRAVITY (IN)	1020.6	992.6	969.7	950.2	933.5	918.8
BLANKET TENSION (LB)	4.05	16.19	36.42	64.74	101.16	145.67
MOMENT OF INERTIA I1	.1869+10	.2033+10	.2201+10	.2373+10	.2551+10	.2733+10
MOMENT OF INERTIA I2	.6552+07	.6571+07	.6602+07	.6645+07	.6700+07	.6767+07
SPECIFIC POWER (KW/KG)	.076	.068	.061	.055	.050	.046
SPECIFIC WEIGHT (KG/KW)	13.2	14.8	16.4	18.1	19.8	21.6
* BOOM PROPERTIES *						
DIAMETER (IN)	15.40	21.93	27.04	31.44	35.40	39.04
EI (LB-IN-SQ)	.26324+08	.10823+09	.25032+09	.45741+09	.73461+09	.10873+10
ROOT SPRING (LB-IN/RAD)	.2679+06	.7736+06	.1451+07	.2280+07	.3253+07	.4365+07
BUCKLING CAPABILITY RATIO	9.56	9.47	9.34	9.15	8.89	8.55
STRENGTH CAPABILITY RATIO	1.03	2.73	4.72	6.87	9.11	11.41
* CANNISTER PROPERTIES *						
HEIGHT (IN)	75.30	86.08	94.51	101.77	108.30	114.31
DIAMETER (IN)	18.17	25.88	31.91	37.10	41.77	46.07
* WEIGHTS (LB) *						
ARRAY	1163.6	1303.0	1445.8	1592.5	1743.3	1898.5
BOOM	92.7	187.9	285.7	386.2	489.5	595.5
CANNISTER	48.2	91.4	134.6	178.5	223.2	268.9
FULL TENSIONER	1.1	2.1	3.6	5.7	8.4	11.8
INTERMEDIATE TENSIONER	.9	1.0	1.1	1.2	1.4	1.6

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	832.0	SUPPORT STRUCTURE =	5.5	INTERCONNECT HARNESS =	41.3
BOX COVER =	37.9	BOX HINGE =	.6	COVER LATCH =	15.0
CONTAINER =	71.5	MAST TIP FITTING =	3.2	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	4.6
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.8		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 40.0 KW   ARRAY WIDTH = 7.50 M

ARRAY LENGTH = 53.76 M   ASPECT RATIO = 7.17   BLANKET AREA = .62500+06 IN=SQ   BLANKET WEIGHT = 832.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.030	.060	.091	.122	.155	.188
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	520.0	574.2	629.4	686.0	743.9	803.3
ARRAY WEIGHT (LB)	1144.0	1263.2	1384.7	1509.1	1636.6	1767.3
CENTER OF GRAVITY (IN)	955.3	930.5	909.6	891.5	875.7	861.6
BLANKET TENSION (LB)	3.78	15.11	33.99	60.43	94.42	135.96
MOMENT OF INERTIA I1	.1606+10	.1725+10	.1847+10	.1972+10	.2099+10	.2230+10
MOMENT OF INERTIA I2	.7510+07	.7531+07	.7564+07	.7610+07	.7669+07	.7741+07
SPECIFIC POWER (KW/KG)	.077	.070	.064	.058	.054	.050
SPECIFIC WEIGHT (KG/KW)	13.0	14.4	15.7	17.1	18.6	20.1
* BOOM PROPERTIES *						
DIAMETER (IN)	14.61	20.78	25.60	29.73	33.43	36.83
EI (LB-IN-SQ)	.21309+08	.87234+08	.20087+09	.36547+09	.58441+09	.86123+09
ROOT SPRING (LB-IN/RAD)	.2286+06	.6580+06	.1230+07	.1927+07	.2740+07	.3665+07
BUCKLING CAPABILITY RATIO	9.47	9.30	9.10	8.85	8.53	8.15
STRENGTH CAPABILITY RATIO	.95	2.55	4.45	6.53	8.72	10.97
* CANNISTER PROPERTIES *						
HEIGHT (IN)	70.67	80.85	88.80	95.62	101.72	107.34
DIAMETER (IN)	17.24	24.52	30.20	35.08	39.45	43.46
* WEIGHTS (LB) *						
ARRAY	1144.0	1263.2	1384.7	1509.1	1636.6	1767.3
BOOM	77.8	157.4	238.9	322.2	407.5	494.7
CANNISTER	43.2	81.8	120.4	159.3	198.9	239.0
FULL TENSIONER	1.1	2.0	3.4	5.4	7.9	11.1
INTERMEDIATE TENSIONER	.9	1.0	1.1	1.2	1.4	1.6

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	832.0	SUPPORT STRUCTURE =	5.5	INTERCONNECT HARNESS =	41.3
BOX COVER =	37.9	BOX HINGE =	.7	COVER LATCH =	14.3
CONTAINER =	72.6	MAST TIP FITTING =	3.2	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	4.6
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.5		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 40.0 KW   ARRAY WIDTH = 8.00 M

ARRAY LENGTH = 50.40 M   ASPECT RATIO = 6.30   BLANKET AREA = .62500+06 IN=SQ   BLANKET WEIGHT = 832.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.026	.053	.080	.108	.136	.165
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	512.9	559.8	607.5	656.1	705.8	756.6
ARRAY WEIGHT (LB)	1128.5	1231.6	1336.4	1443.4	1552.7	1664.4
CENTER OF GRAVITY (IN)	897.7	875.6	856.7	840.0	825.2	811.9
BLANKET TENSION (LB)	3.54	14.16	31.87	56.65	88.52	127.46
MOMENT OF INERTIA I1	.1396+10	.1485+10	.1575+10	.1667+10	.1761+10	.1857+10
MOMENT OF INERTIA I2	.8536+07	.8558+07	.8593+07	.8642+07	.8705+07	.8781+07
SPECIFIC POWER (KW/KG)	.078	.071	.066	.061	.057	.053
SPECIFIC WEIGHT (KG/KW)	12.8	14.0	15.2	16.4	17.6	18.9
* BOOM PROPERTIES *						
DIAMETER (IN)	13.91	19.76	24.32	28.22	31.71	34.91
EI (LB-IN-SQ)	.17498+08	.71384+08	.16381+09	.29701+09	.47332+09	.69512+09
ROOT SPRING (LB-IN/RAD)	.1972+06	.5661+06	.1056+07	.1649+07	.2339+07	.3121+07
BUCKLING CAPABILITY RATIO	9.38	9.15	8.90	8.59	8.22	7.81
STRENGTH CAPABILITY RATIO	.89	2.39	4.20	6.20	8.32	10.53
* CANNISTER PROPERTIES *						
HEIGHT (IN)	66.60	76.26	83.79	90.23	95.98	101.26
DIAMETER (IN)	16.41	23.32	28.70	33.31	37.42	41.19
* WEIGHTS (LB) *						
ARRAY	1128.5	1231.6	1336.4	1443.4	1552.7	1664.4
BOOM	66.1	133.5	202.2	272.3	343.8	416.6
CANNISTER	39.0	73.8	108.5	143.4	178.7	214.5
FULL TENSIONER	1.1	1.9	3.2	5.1	7.5	10.4
INTERMEDIATE TENSIONER	.9	1.0	1.1	1.2	1.3	1.5

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	832.0	SUPPORT STRUCTURE =	5.5	INTERCONNECT HARNESS =	41.3
BOX COVER =	37.9	BOX HINGE =	.9	COVER LATCH =	13.6
CONTAINER =	73.8	MAST TIP FITTING =	3.2	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	4.6
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.3		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 40.0 KW   ARRAY WIDTH = 8.50 M

ARRAY LENGTH = 47.44 M   ASPECT RATIO = 5.58   BLANKET AREA = .62500+06 IN-SQ   BLANKET WEIGHT = 832.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.023	.047	.071	.096	.121	.146
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	507.3	548.3	589.8	632.1	675.3	719.2
ARRAY WEIGHT (LB)	1116.0	1206.2	1297.6	1390.7	1485.6	1582.3
CENTER OF GRAVITY (IN)	846.6	826.9	809.7	794.4	780.6	768.0
BLANKET TENSION (LB)	3.33	13.33	29.99	53.32	83.31	119.96
MOMENT OF INERTIA I1	.1226+10	.1293+10	.1362+10	.1431+10	.1502+10	.1574+10
MOMENT OF INERTIA I2	.9628+07	.9652+07	.9689+07	.9741+07	.9808+07	.9889+07
SPECIFIC POWER (KW/KG)	.079	.073	.068	.063	.059	.056
SPECIFIC WEIGHT (KG/KW)	12.7	13.7	14.7	15.8	16.9	18.0
* BOOM PROPERTIES *						
DIAMETER (IN)	13.28	18.86	23.19	26.90	30.20	33.22
EI (LB-IN-SQ)	.14548+08	.59185+08	.13544+09	.24489+09	.38918+09	.56998+09
ROOT SPRING (LB-IN/RAD)	.1717+06	.4919+06	.9152+06	.1427+07	.2020+07	.2689+07
BUCKLING CAPABILITY RATIO	9.30	9.02	8.71	8.36	7.95	7.51
STRENGTH CAPABILITY RATIO	.83	2.25	3.97	5.89	7.94	10.09
* CANNISTER PROPERTIES *						
HEIGHT (IN)	63.00	72.20	79.36	85.47	90.91	95.90
DIAMETER (IN)	15.67	22.25	27.37	31.74	35.63	39.20
* WEIGHTS (LB) *						
ARRAY	1116.0	1206.2	1297.6	1390.7	1485.6	1582.3
BOOM	56.7	114.4	173.1	232.7	293.4	355.1
CANNISTER	35.5	67.1	98.5	130.1	161.9	194.0
FULL TENSIONER	1.1	1.9	3.1	4.9	7.1	9.9
INTERMEDIATE TENSIONER	.9	1.0	1.1	1.2	1.3	1.5

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	832.0	SUPPORT STRUCTURE =	5.5	INTERCONNECT HARNESS =	41.3
BOX COVER =	37.9	BOX HINGE =	1.1	COVER LATCH =	13.0
CONTAINER =	74.9	MAST TIP FITTING =	3.2	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	4.6
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.0		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 40.0 KW   ARRAY WIDTH = 9.00 M

ARRAY LENGTH = 44.80 M   ASPECT RATIO = 4.98   BLANKET AREA = .62500+06 IN=SQ   BLANKET WEIGHT = 832.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.021	.043	.064	.086	.109	.131
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	502.7	538.9	575.5	612.6	650.4	689.0
ARRAY WEIGHT (LB)	1106.0	1185.5	1266.0	1347.8	1431.0	1515.7
CENTER OF GRAVITY (IN)	800.9	783.2	767.7	753.6	740.8	729.0
BLANKET TENSION (LB)	3.15	12.59	28.32	50.36	78.68	113.30
MOMENT OF INERTIA I1	.1086+10	.1137+10	.1190+10	.1243+10	.1297+10	.1352+10
MOMENT OF INERTIA I2	.1079+08	.1081+08	.1085+08	.1091+08	.1098+08	.1106+08
SPECIFIC POWER (KW/KG)	.080	.074	.070	.065	.061	.058
SPECIFIC WEIGHT (KG/KW)	12.6	13.5	14.4	15.3	16.3	17.2
* BOOM PROPERTIES *						
DIAMETER (IN)	12.71	18.05	22.18	25.71	28.85	31.72
EI (LB-IN-SQ)	.12228+08	.49634+08	.11333+09	.20445+09	.32418+09	.47372+09
ROOT SPRING (LB-IN/RAD)	.1507+06	.4311+06	.8007+06	.1246+07	.1761+07	.2341+07
BUCKLING CAPABILITY RATIO	9.23	8.89	8.54	8.14	7.71	7.25
STRENGTH CAPABILITY RATIO	.78	2.12	3.76	5.59	7.57	9.66
* CANNISTER PROPERTIES *						
HEIGHT (IN)	59.78	68.58	75.41	81.23	86.41	91.14
DIAMETER (IN)	15.00	21.29	26.18	30.34	34.04	37.43
* WEIGHTS (LB) *						
ARRAY	1106.0	1185.5	1266.0	1347.8	1431.0	1515.7
BOOM	49.1	99.0	149.5	200.8	252.9	305.7
CANNISTER	32.4	61.3	90.0	118.7	147.6	176.7
FULL TENSIONER	1.0	1.8	3.0	4.6	6.8	9.4
INTERMEDIATE TENSIONER	.9	1.0	1.1	1.2	1.3	1.4

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	832.0	SUPPORT STRUCTURE =	5.5	INTERCONNECT HARNESS =	41.3
BOX COVER =	37.9	BOX HINGE =	1.3	COVER LATCH =	12.5
CONTAINER =	76.0	MAST TIP FITTING =	3.2	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	4.6
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.8		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 40.0 KW ARRAY WIDTH = 9.50 M

ARRAY LENGTH = 42.44 M ASPECT RATIO = 4.47 BLANKET AREA = .62500+06 IN*SQ BLANKET WEIGHT = 832.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.019	.039	.058	.078	.098	.119
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	499.1	531.1	563.6	596.6	630.0	664.1
ARRAY WEIGHT (LB)	1098.0	1168.5	1239.9	1312.4	1386.1	1461.0
CENTER OF GRAVITY (IN)	759.6	743.9	729.8	716.9	705.0	694.0
BLANKET TENSION (LB)	3.00	11.93	26.83	47.71	74.54	107.34
MOMENT OF INERTIA I1	.9688+09	.1009+10	.1050+10	.1092+10	.1134+10	.1176+10
MOMENT OF INERTIA I2	.1202+08	.1204+08	.1208+08	.1214+08	.1222+08	.1231+08
SPECIFIC POWER (KW/KG)	.080	.075	.071	.067	.063	.060
SPECIFIC WEIGHT (KG/KW)	12.5	13.3	14.1	14.9	15.8	16.6
* BOOM PROPERTIES *						
DIAMETER (IN)	12.22	17.31	21.27	24.64	27.64	30.37
EI (LB*IN*SQ)	.10442+08	.42046+08	.95825+08	.17256+09	.27310+09	.39833+09
ROOT SPRING (LB*IN/RAD)	.1339+06	.3806+06	.7061+06	.1098+07	.1549+07	.2055+07
BUCKLING CAPABILITY RATIO	9.16	8.78	8.38	7.95	7.49	7.02
STRENGTH CAPABILITY RATIO	.73	2.00	3.56	5.32	7.22	9.24
* CANNISTER PROPERTIES *						
HEIGHT (IN)	56.93	65.33	71.86	77.42	82.37	86.88
DIAMETER (IN)	14.42	20.43	25.10	29.08	32.61	35.84
* WEIGHTS (LB) *						
ARRAY	1098.0	1168.5	1239.9	1312.4	1386.1	1461.0
BOOM	43.0	86.3	130.3	174.8	219.9	265.6
CANNISTER	29.9	56.3	82.6	108.9	135.3	161.9
FULL TENSIONER	1.0	1.8	2.9	4.4	6.4	8.9
INTERMEDIATE TENSIONER	.9	1.0	1.1	1.1	1.3	1.4

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	832.0	SUPPORT STRUCTURE =	5.5	INTERCONNECT HARNESS =	41.3
BOX COVER =	37.9	BOX HINGE =	1.5	COVER LATCH =	12.1
CONTAINER =	77.2	MAST TIP FITTING =	3.2	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	4.6
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.6		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 40.0 KW   ARRAY WIDTH =10.00 M

ARRAY LENGTH = 40.32 M   ASPECT RATIO = 4.03   BLANKET AREA = .62500+06 IN-SQ   BLANKET WEIGHT = 832.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.018	.035	.053	.072	.090	.108
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.055
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	496.8	524.7	553.8	583.2	613.0	643.4
ARRAY WEIGHT (LB)	1092.9	1154.4	1218.3	1283.0	1348.7	1415.4
CENTER OF GRAVITY (IN)	722.0	708.2	695.4	683.6	672.6	662.3
BLANKET TENSION (LB)	3.00	11.33	25.49	45.32	70.81	101.97
MOMENT OF INERTIA I1	.8708+09	.9019+09	.9343+09	.9671+09	.1000+10	.1034+10
MOMENT OF INERTIA I2	.1331+08	.1334+08	.1338+08	.1344+08	.1352+08	.1362+08
SPECIFIC POWER (KW/KG)	.081	.076	.072	.069	.065	.062
SPECIFIC WEIGHT (KG/KW)	12.4	13.1	13.8	14.6	15.3	16.1
* BOOM PROPERTIES *						
DIAMETER (IN)	11.91	16.65	20.45	23.68	26.54	29.16
EI (LB-IN-SQ)	.94123+07	.35938+08	.81779+08	.14703+09	.23235+09	.33838+09
ROOT SPRING (LB-IN/RAD)	.1239+06	.3384+06	.6269+06	.9734+06	.1372+07	.1819+07
BUCKLING CAPABILITY RATIO	9.08	8.67	8.24	7.77	7.29	6.81
STRENGTH CAPABILITY RATIO	.72	1.89	3.37	5.06	6.89	8.84
* CANNISTER PROPERTIES *						
HEIGHT (IN)	54.57	62.39	68.66	73.99	78.72	83.04
DIAMETER (IN)	14.05	19.64	24.13	27.94	31.32	34.41
* WEIGHTS (LB) *						
ARRAY	1092.9	1154.4	1218.3	1283.0	1348.7	1415.4
BOOM	38.8	75.8	114.3	153.3	192.7	232.5
CANNISTER	28.2	52.0	76.2	100.4	124.6	149.1
FULL TENSIONER	1.0	1.7	2.8	4.3	6.2	8.5
INTERMEDIATE TENSIONER	.9	1.0	1.0	1.1	1.3	1.4

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	832.0	SUPPORT STRUCTURE =	5.5	INTERCONNECT HARNESS =	41.3
BOX COVER =	37.9	BOX HINGE =	1.7	COVER LATCH =	11.6
CONTAINER =	78.3	MAST TIP FITTING =	3.2	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	4.6
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.5		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 45.0 KW   ARRAY WIDTH = 7.00 M

ARRAY LENGTH = 64.80 M   ASPECT RATIO = 9.26   BLANKET AREA = .70313+06 IN-SQ   BLANKET WEIGHT = 936.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.045	.054
***** TORSIONAL FREQUENCY HZ *****	.038	.077	.118	.160	.203	.248
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.045	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	610.9	698.9	789.6	883.5	980.6	1081.2
ARRAY WEIGHT (LB)	1344.1	1537.6	1737.2	1943.7	2157.4	2378.6
CENTER OF GRAVITY (IN)	1144.2	1111.9	1086.3	1065.1	1047.2	1031.9
BLANKET TENSION (LB)	5.12	20.48	46.09	81.94	128.03	184.36
MOMENT OF INERTIA I1	.2721+10	.3018+10	.3326+10	.3645+10	.3975+10	.4315+10
MOMENT OF INERTIA I2	.7368+07	.7392+07	.7431+07	.7485+07	.7554+07	.7639+07
SPECIFIC POWER (KW/KG)	.074	.064	.057	.051	.046	.042
SPECIFIC WEIGHT (KG/KW)	13.6	15.5	17.5	19.6	21.8	24.0
* BOOM PROPERTIES *						
DIAMETER (IN)	17.36	24.76	30.59	35.63	40.18	44.40
EI (LB-IN-SQ)	.42461+08	.17586+09	.40971+09	.75415+09	.12200+10	.18188+10
ROOT SPRING (LB-IN/RAD)	.3835+06	.1113+07	.2099+07	.3318+07	.4759+07	.6420+07
BUCKLING CAPABILITY RATIO	9.69	9.70	9.66	9.55	9.35	9.04
STRENGTH CAPABILITY RATIO	1.14	2.97	5.07	7.31	9.60	11.92
* CANNISTER PROPERTIES *						
HEIGHT (IN)	84.77	96.98	106.60	114.92	122.43	129.39
DIAMETER (IN)	20.48	29.22	36.09	42.04	47.41	52.39
* WEIGHTS (LB) *						
ARRAY	1344.1	1537.6	1737.2	1943.7	2157.4	2378.6
BOOM	132.4	269.4	411.2	557.9	709.6	866.5
CANNISTER	61.2	116.4	172.1	229.1	287.4	347.4
FULL TENSIONER	1.2	2.4	4.3	7.0	10.5	14.7
INTERMEDIATE TENSIONER	1.0	1.0	1.1	1.3	1.5	1.8

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	936.0	SUPPORT STRUCTURE =	6.0	INTERCONNECT HARNESS =	46.5
BOX COVER =	42.6	BOX HINGE =	.6	COVER LATCH =	20.0
CONTAINER =	78.4	MAST TIP FITTING =	3.3	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	5.2
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	6.4		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 45.0 KW ARRAY WIDTH = 7.50 M

ARRAY LENGTH = 60.48 M ASPECT RATIO = 8.06 BLANKET AREA = .70313+06 IN*SQ BLANKET WEIGHT = 936.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.033	.067	.102	.139	.176	.214
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	598.3	673.3	750.2	829.3	910.9	994.9
ARRAY WEIGHT (LB)	1316.3	1481.2	1650.4	1824.5	2003.9	2188.8
CENTER OF GRAVITY (IN)	1071.4	1042.3	1018.7	998.7	981.5	966.5
BLANKET TENSION (LB)	4.78	19.12	43.02	76.48	119.50	172.07
MOMENT OF INERTIA I1	.2330+10	.2546+10	.2769+10	.2998+10	.3234+10	.3477+10
MOMENT OF INERTIA I2	.8443+07	.8469+07	.8511+07	.8569+07	.8643+07	.8734+07
SPECIFIC POWER (KW/KG)	.075	.067	.060	.054	.049	.045
SPECIFIC WEIGHT (KG/KW)	13.3	15.0	16.7	18.4	20.2	22.1
* BOOM PROPERTIES *						
DIAMETER (IN)	16.46	23.45	28.93	33.65	37.89	41.82
EI (LB*IN*SQ)	.34332+08	.14141+09	.32764+09	.59979+09	.96500+09	.14308+10
ROOT SPRING (LB*IN/RAD)	.3270+06	.9454+06	.1775+07	.2794+07	.3991+07	.5363+07
BUCKLING CAPABILITY RATIO	9.59	9.51	9.40	9.21	8.94	8.58
STRENGTH CAPABILITY RATIO	1.06	2.79	4.81	6.99	9.25	11.56
* CANNISTER PROPERTIES *						
HEIGHT (IN)	79.54	91.07	100.12	107.90	114.91	121.38
DIAMETER (IN)	19.42	27.67	34.13	39.70	44.71	49.34
* WEIGHTS (LB) *						
ARRAY	1316.3	1481.2	1650.4	1824.5	2003.9	2188.8
BOOM	111.1	225.5	343.2	464.4	589.1	717.3
CANNISTER	54.8	104.1	153.7	204.0	255.3	307.8
FULL TENSIONER	1.2	2.3	4.1	6.6	9.8	13.8
INTERMEDIATE TENSIONER	1.0	1.0	1.1	1.3	1.5	1.7

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	936.0	SUPPORT STRUCTURE =	6.0	INTERCONNECT HARNESS =	46.5
BOX COVER =	42.6	BOX HINGE =	.8	COVER LATCH =	18.9
CONTAINER =	79.6	MAST TIP FITTING =	3.3	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	5.2
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	6.1		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 45.0 KW ARRAY WIDTH = 8.00 M

ARRAY LENGTH = 56.70 M ASPECT RATIO = 7.09 BLANKET AREA = .70313+06 IN=SQ BLANKET WEIGHT = 936.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.029	.059	.090	.122	.154	.187
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	588.3	653.0	719.0	786.8	856.3	927.7
ARRAY WEIGHT (LB)	1294.3	1436.5	1581.9	1730.9	1883.9	2041.0
CENTER OF GRAVITY (IN)	1007.2	981.1	959.3	940.6	924.3	909.8
BLANKET TENSION (LB)	4.48	17.92	40.33	71.70	112.03	161.32
MOMENT OF INERTIA I1	.2020+10	.2181+10	.2346+10	.2515+10	.2688+10	.2865+10
MOMENT OF INERTIA I2	.9593+07	.9621+07	.9665+07	.9727+07	.9807+07	.9904+07
SPECIFIC POWER (KW/KG)	.076	.069	.063	.057	.053	.049
SPECIFIC WEIGHT (KG/KW)	13.1	14.5	16.0	17.5	19.0	20.6
* BOOM PROPERTIES *						
DIAMETER (IN)	15.66	22.29	27.47	31.92	35.91	39.58
EI (LB=IN=SQ)	.28166+08	.11551+09	.26646+09	.48566+09	.77799+09	.11485+10
ROOT SPRING (LB=IN/RAD)	.2819+06	.8123+06	.1520+07	.2385+07	.3396+07	.4548+07
BUCKLING CAPABILITY RATIO	9.50	9.35	9.17	8.92	8.59	8.19
STRENGTH CAPABILITY RATIO	.99	2.63	4.57	6.68	8.89	11.17
* CANNISTER PROPERTIES *						
HEIGHT (IN)	74.96	85.89	94.44	101.78	108.36	114.42
DIAMETER (IN)	18.48	26.30	32.41	37.66	42.37	46.70
* WEIGHTS (LB) *						
ARRAY	1294.3	1436.5	1581.9	1730.9	1883.9	2041.0
BOOM	94.3	191.1	290.2	391.8	495.9	602.5
CANNISTER	49.5	93.9	138.3	183.3	229.0	275.5
FULL TENSIONER	1.2	2.2	3.9	6.2	9.3	13.0
INTERMEDIATE TENSIONER	.9	1.0	1.1	1.3	1.4	1.7

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	936.0	SUPPORT STRUCTURE =	6.0	INTERCONNECT HARNESS =	46.5
BOX COVER =	42.6	BOX HINGE =	1.0	COVER LATCH =	18.0
CONTAINER =	80.7	MAST TIP FITTING =	3.3	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	5.2
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.8		

ORIGINAL PAGE IS
OF POOR QUALITY

ARRAY TYPE LMSC FOLDOUT POWER/WING = 45.0 KW ARRAY WIDTH = 8.50 M

ARRAY LENGTH = 53.37 M ASPECT RATIO = 6.28 BLANKET AREA = .70313+06 IN-SQ BLANKET WEIGHT = 936.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.026	.053	.080	.108	.136	.165
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	580.3	636.6	694.1	752.7	812.8	874.3
ARRAY WEIGHT (LB)	1276.6	1400.6	1526.9	1656.0	1788.2	1923.5
CENTER OF GRAVITY (IN)	950.2	926.8	906.8	889.3	873.9	860.1
BLANKET TENSION (LB)	4.22	16.87	37.96	67.48	105.44	151.83
MOMENT OF INERTIA I1	.1770+10	.1891+10	.2016+10	.2143+10	.2273+10	.2405+10
MOMENT OF INERTIA I2	.1082+08	.1085+08	.1089+08	.1096+08	.1105+08	.1115+08
SPECIFIC POWER (KW/KG)	.078	.071	.065	.060	.055	.051
SPECIFIC WEIGHT (KG/KW)	12.9	14.1	15.4	16.7	18.1	19.4
* BOOM PROPERTIES *						
DIAMETER (IN)	14.95	21.26	26.18	30.39	34.16	37.62
EI (LB-IN-SQ)	.23400+08	.95628+08	.21982+09	.39926+09	.63736+09	.93765+09
ROOT SPRING (LB-IN/RAD)	.2453+06	.7050+06	.1316+07	.2059+07	.2924+07	.3906+07
BUCKLING CAPABILITY RATIO	9.42	9.21	8.97	8.66	8.29	7.86
STRENGTH CAPABILITY RATIO	.92	2.48	4.33	6.37	8.53	10.76
* CANNISTER PROPERTIES *						
HEIGHT (IN)	70.90	81.31	89.42	96.37	102.59	108.30
DIAMETER (IN)	17.65	25.09	30.89	35.86	40.31	44.39
* WEIGHTS (LB) *						
ARRAY	1276.6	1400.6	1526.9	1656.0	1788.2	1923.5
BOOM	80.9	163.6	248.1	334.3	422.4	512.3
CANNISTER	45.0	85.2	125.4	166.0	207.0	248.7
FULL TENSIONER	1.1	2.1	3.7	5.9	8.8	12.2
INTERMEDIATE TENSIONER	.9	1.0	1.1	1.2	1.4	1.6

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	936.0	SUPPORT STRUCTURE =	6.0	INTERCONNECT HARNESS =	46.5
BOX COVER =	42.6	BOX HINGE =	1.2	COVER LATCH =	17.2
CONTAINER =	81.8	MAST TIP FITTING =	3.3	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	5.2
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.5		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 45.0 KW   ARRAY WIDTH = 9.00 M

ARRAY LENGTH = 50.40 M   ASPECT RATIO = 5.60   BLANKET AREA = .70313+06 IN=SQ   BLANKET WEIGHT = 936.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.024	.047	.072	.097	.122	.147
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	573.7	623.3	673.7	725.1	777.6	831.2
ARRAY WEIGHT (LB)	1262.2	1371.3	1482.2	1595.3	1710.7	1828.6
CENTER OF GRAVITY (IN)	899.2	878.1	859.8	843.6	829.1	816.0
BLANKET TENSION (LB)	3.98	15.93	35.85	63.73	99.58	143.39
MOMENT OF INERTIA I1	.1564+10	.1658+10	.1753+10	.1851+10	.1950+10	.2051+10
MOMENT OF INERTIA I2	.1212+08	.1215+08	.1220+08	.1227+08	.1236+08	.1247+08
SPECIFIC POWER (KW/KG)	.078	.072	.067	.062	.058	.054
SPECIFIC WEIGHT (KG/KW)	12.7	13.9	15.0	16.1	17.3	18.5
* BOOM PROPERTIES *						
DIAMETER (IN)	14.32	20.34	25.03	29.03	32.61	35.89
EI (LB=IN=SQ)	.19656+08	.80100+08	.18361+09	.33253+09	.52932+09	.77651+09
ROOT SPRING (LB=IN/RAD)	.2152+06	.6172+06	.1150+07	.1795+07	.2544+07	.3391+07
BUCKLING CAPABILITY RATIO	9.34	9.08	8.79	8.43	8.02	7.57
STRENGTH CAPABILITY RATIO	.86	2.34	4.11	6.08	8.18	10.36
* CANNISTER PROPERTIES *						
HEIGHT (IN)	67.28	77.22	84.95	91.56	97.47	102.88
DIAMETER (IN)	16.89	24.00	29.53	34.26	38.48	42.35
* WEIGHTS (LB) *						
ARRAY	1262.2	1371.3	1482.2	1595.3	1710.7	1828.6
BOOM	70.1	141.4	214.1	288.2	363.6	440.3
CANNISTER	41.1	77.9	114.5	151.3	188.5	226.1
FULL TENSIONER	1.1	2.1	3.5	5.6	8.3	11.6
INTERMEDIATE TENSIONER	.9	1.0	1.1	1.2	1.4	1.6

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	936.0	SUPPORT STRUCTURE =	6.0	INTERCONNECT HARNESS =	46.5
BOX COVER =	42.6	BOX HINGE =	1.4	COVER LATCH =	16.4
CONTAINER =	83.0	MAST TIP FITTING =	3.3	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	5.2
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.3		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 45.0 KW   ARRAY WIDTH = 9.50 M

ARRAY LENGTH = 47.75 M   ASPECT RATIO = 5.03   BLANKET AREA = .70313+06 IN-SQ   BLANKET WEIGHT = 936.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.021	.043	.065	.087	.110	.133
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	568.4	612.4	657.0	702.4	748.7	795.9
ARRAY WEIGHT (LB)	1250.4	1347.2	1445.4	1545.3	1647.1	1750.9
CENTER OF GRAVITY (IN)	853.3	834.3	817.5	802.5	788.9	776.5
BLANKET TENSION (LB)	3.77	15.09	33.96	60.38	94.34	135.85
MOMENT OF INERTIA I1	.1393+10	.1467+10	.1541+10	.1617+10	.1694+10	.1772+10
MOMENT OF INERTIA I2	.1349+08	.1353+08	.1358+08	.1365+08	.1375+08	.1386+08
SPECIFIC POWER (KW/KG)	.079	.073	.068	.064	.060	.057
SPECIFIC WEIGHT (KG/KW)	12.6	13.6	14.6	15.6	16.6	17.7
* BOOM PROPERTIES *						
DIAMETER (IN)	13.74	19.51	23.99	27.81	31.22	34.34
EI (LB-IN-SQ)	.16674+08	.67788+08	.15502+09	.28010+09	.44482+09	.65101+09
ROOT SPRING (LB-IN/RAD)	.1902+06	.5446+06	.1013+07	.1578+07	.2233+07	.2971+07
BUCKLING CAPABILITY RATIO	9.27	8.96	8.62	8.23	7.78	7.31
STRENGTH CAPABILITY RATIO	.81	2.21	3.91	5.80	7.83	9.96
* CANNISTER PROPERTIES *						
HEIGHT (IN)	64.03	73.55	80.94	87.25	92.88	98.02
DIAMETER (IN)	16.21	23.02	28.31	32.82	36.84	40.52
* WEIGHTS (LB) *						
ARRAY	1250.4	1347.2	1445.4	1545.3	1647.1	1750.9
BOOM	61.1	123.3	186.4	250.5	315.7	382.0
CANNISTER	37.7	71.5	105.0	138.7	172.6	206.9
FULL TENSIONER	1.1	2.0	3.4	5.4	7.9	11.0
INTERMEDIATE TENSIONER	.9	1.0	1.1	1.2	1.4	1.6

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	936.0	SUPPORT STRUCTURE =	6.0	INTERCONNECT HARNESS =	46.5
BOX COVER =	42.6	BOX HINGE =	1.6	COVER LATCH =	15.8
CONTAINER =	84.1	MAST TIP FITTING =	3.3	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	5.2
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.1		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 45.0 KW   ARRAY WIDTH =10.00 M

ARRAY LENGTH = 45.36 M   ASPECT RATIO = 4.54   BLANKET AREA = .70313+06 IN*SQ   BLANKET WEIGHT = 936.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.019	.039	.059	.079	.100	.121
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	563.9	603.2	643.0	683.5	724.6	766.5
ARRAY WEIGHT (LB)	1240.6	1327.1	1414.7	1503.7	1594.2	1686.4
CENTER OF GRAVITY (IN)	811.7	794.5	779.2	765.4	752.7	740.9
BLANKET TENSION (LB)	3.58	14.34	32.26	57.36	89.62	129.06
MOMENT OF INERTIA I1	.1250+10	.1308+10	.1366+10	.1426+10	.1487+10	.1548+10
MOMENT OF INERTIA I2	.1495+08	.1498+08	.1504+08	.1511+08	.1521+08	.1533+08
SPECIFIC POWER (KW/KG)	.080	.075	.070	.066	.062	.059
SPECIFIC WEIGHT (KG/KW)	12.5	13.4	14.3	15.2	16.1	17.0
* BOOM PROPERTIES *						
DIAMETER (IN)	13.21	18.75	23.05	26.71	29.97	32.95
EI (LB*IN*SQ)	.14268+08	.57893+08	.13213+09	.23828+09	.37767+09	.55166+09
ROOT SPRING (LB*IN/RAD)	.1692+06	.4838+06	.8984+06	.1398+07	.1975+07	.2624+07
BUCKLING CAPABILITY RATIO	9.21	8.85	8.47	8.04	7.57	7.08
STRENGTH CAPABILITY RATIO	.77	2.09	3.72	5.54	7.50	9.57
* CANNISTER PROPERTIES *						
HEIGHT (IN)	61.09	70.23	77.33	83.37	88.74	93.66
DIAMETER (IN)	15.59	22.13	27.20	31.52	35.37	38.88
* WEIGHTS (LB) *						
ARRAY	1240.6	1327.1	1414.7	1503.7	1594.2	1686.4
BOOM	53.7	108.2	163.5	219.5	276.4	334.0
CANNISTER	34.8	66.0	96.8	127.7	158.9	190.2
FULL TENSIONER	1.1	1.9	3.3	5.2	7.6	10.5
INTERMEDIATE TENSIONER	.9	1.0	1.1	1.2	1.3	1.5

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	936.0	SUPPORT STRUCTURE =	6.0	INTERCONNECT HARNESS =	46.5
BOX COVER =	42.6	BOX HINGE =	1.9	COVER LATCH =	15.2
CONTAINER =	85.2	MAST TIP FITTING =	3.3	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	5.2
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	4.9		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 50.0 KW   ARRAY WIDTH = 7.00 M

ARRAY LENGTH = 72.00 M   ASPECT RATIO = 10.29   BLANKET AREA = .78125+06 IN-SQ   BLANKET WEIGHT = 1040.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.042	.086	.132	.180	.230	.281
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.045	.053
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	698.9	817.4	940.6	1069.1	1203.0	1342.6
ARRAY WEIGHT (LB)	1537.6	1798.3	2069.4	2352.0	2646.6	2953.6
CENTER OF GRAVITY (IN)	1266.6	1230.5	1202.8	1180.6	1162.2	1146.7
BLANKET TENSION (LB)	6.32	25.29	56.90	101.16	158.06	227.61
MOMENT OF INERTIA I1	.3825+10	.4335+10	.4867+10	.5421+10	.5999+10	.6601+10
MOMENT OF INERTIA I2	.8192+07	.8221+07	.8269+07	.8336+07	.8421+07	.8526+07
SPECIFIC POWER (KW/KG)	.072	.061	.053	.047	.042	.037
SPECIFIC WEIGHT (KG/KW)	14.0	16.3	18.8	21.4	24.1	26.9
* BOOM PROPERTIES *						
DIAMETER (IN)	19.32	27.62	34.19	39.91	45.10	49.94
EI (LB-IN-SQ)	.65231+08	.27239+09	.63977+09	.11872+10	.19362+10	.29098+10
ROOT SPRING (LB-IN/RAD)	.5291+06	.1546+07	.2933+07	.4663+07	.6729+07	.9133+07
BUCKLING CAPABILITY RATIO	9.82	9.93	10.00	9.98	9.84	9.58
STRENGTH CAPABILITY RATIO	1.24	3.18	5.37	7.65	9.97	12.29
* CANNISTER PROPERTIES *						
HEIGHT (IN)	94.25	107.94	118.79	128.22	136.78	144.76
DIAMETER (IN)	22.80	32.59	40.35	47.09	53.22	58.92
* WEIGHTS (LB) *						
ARRAY	1537.6	1798.3	2069.4	2352.0	2646.6	2953.6
BOOM	182.3	372.6	571.0	777.8	993.3	1217.7
CANNISTER	75.8	144.7	214.9	287.1	361.7	438.8
FULL TENSIONER	1.3	2.8	5.1	8.4	12.7	17.9
INTERMEDIATE TENSIONER	1.0	1.0	1.2	1.4	1.7	2.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1040.0	SUPPORT STRUCTURE =	6.4	INTERCONNECT HARNESS =	51.7
BOX COVER =	47.4	BOX HINGE =	.7	COVER LATCH =	26.2
CONTAINER =	85.4	MAST TIP FITTING =	3.5	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	5.8
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	7.0		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 50.0 KW   ARRAY WIDTH = 7.50 M

ARRAY LENGTH = 67.20 M   ASPECT RATIO = 8.96   BLANKET AREA = .78125+06 IN=SQ   BLANKET WEIGHT = 1040.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.045	.054
***** TORSIONAL FREQUENCY HZ *****	.037	.075	.114	.155	.197	.241
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.045	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	681.7	782.3	886.3	994.0	1105.7	1221.4
ARRAY WEIGHT (LB)	1499.7	1721.1	1949.8	2186.8	2432.4	2687.0
CENTER OF GRAVITY (IN)	1186.3	1153.4	1127.4	1106.0	1088.0	1072.5
BLANKET TENSION (LB)	5.90	23.60	53.11	94.42	147.53	212.44
MOMENT OF INERTIA I1	.3263+10	.3633+10	.4017+10	.4414+10	.4826+10	.5252+10
MOMENT OF INERTIA I2	.9385+07	.9416+07	.9467+07	.9539+07	.9631+07	.9743+07
SPECIFIC POWER (KW/KG)	.073	.064	.056	.050	.045	.041
SPECIFIC WEIGHT (KG/KW)	13.6	15.6	17.7	19.9	22.1	24.4
* BOOM PROPERTIES *						
DIAMETER (IN)	18.32	26.14	32.30	37.64	42.46	46.94
EI (LB=IN=SQ)	.52675+08	.21847+09	.50965+09	.93938+09	.15217+10	.22717+10
ROOT SPRING (LB=IN/RAD)	.4507+06	.1310+07	.2473+07	.3912+07	.5617+07	.7586+07
BUCKLING CAPABILITY RATIO	9.71	9.73	9.70	9.58	9.36	9.03
STRENGTH CAPABILITY RATIO	1.15	3.01	5.13	7.37	9.67	12.00
* CANNISTER PROPERTIES *						
HEIGHT (IN)	88.43	101.34	111.51	120.31	128.27	135.66
DIAMETER (IN)	21.61	30.84	38.12	44.42	50.11	55.39
* WEIGHTS (LB) *						
ARRAY	1499.7	1721.1	1949.8	2186.8	2432.4	2687.0
BOOM	152.9	311.4	475.6	645.8	821.9	1004.2
CANNISTER	67.9	129.3	191.5	255.1	320.3	387.5
FULL TENSIONER	1.3	2.6	4.8	7.9	11.9	16.8
INTERMEDIATE TENSIONER	1.0	1.0	1.2	1.4	1.6	1.9

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1040.0	SUPPORT STRUCTURE =	6.4	INTERCONNECT HARNESS =	51.7
BOX COVER =	47.4	BOX HINGE =	.9	COVER LATCH =	24.7
CONTAINER =	86.5	MAST TIP FITTING =	3.5	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	5.8
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	6.6		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 50.0 KW   ARRAY WIDTH = 8.00 M

ARRAY LENGTH = 63.00 M   ASPECT RATIO = 7.88   BLANKET AREA = .78125+06 IN-SQ   BLANKET WEIGHT = 1040.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.045	.054
***** TORSIONAL FREQUENCY HZ *****	.032	.066	.100	.136	.172	.210
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.045	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	668.0	754.6	843.6	935.3	1030.0	1127.6
ARRAY WEIGHT (LB)	1469.6	1660.1	1855.8	2057.7	2265.9	2480.8
CENTER OF GRAVITY (IN)	1115.6	1085.7	1061.5	1041.2	1023.7	1008.5
BLANKET TENSION (LB)	5.53	22.13	49.79	88.52	138.31	199.16
MOMENT OF INERTIA I1	.2821+10	.3095+10	.3378+10	.3670+10	.3971+10	.4281+10
MOMENT OF INERTIA I2	.1066+08	.1069+08	.1075+08	.1082+08	.1092+08	.1104+08
SPECIFIC POWER (KW/KG)	.075	.066	.059	.053	.049	.044
SPECIFIC WEIGHT (KG/KW)	13.4	15.1	16.9	18.7	20.6	22.6
* BOOM PROPERTIES *						
DIAMETER (IN)	17.43	24.84	30.65	35.67	40.19	44.36
EI (LB-IN-SQ)	.43169+08	.17808+09	.41321+09	.75754+09	.12206+10	.18125+10
ROOT SPRING (LB-IN/RAD)	.3882+06	.1124+07	.2113+07	.3329+07	.4761+07	.6404+07
BUCKLING CAPABILITY RATIO	9.62	9.55	9.44	9.25	8.96	8.59
STRENGTH CAPABILITY RATIO	1.08	2.84	4.89	7.08	9.36	11.67
* CANNISTER PROPERTIES *						
HEIGHT (IN)	83.33	95.55	105.15	113.42	120.88	127.77
DIAMETER (IN)	20.56	29.31	36.17	42.09	47.42	52.35
* WEIGHTS (LB) *						
ARRAY	1469.6	1660.1	1855.8	2057.7	2265.9	2480.8
BOOM	129.8	263.6	401.5	543.7	690.1	840.9
CANNISTER	61.2	116.5	172.2	228.8	286.6	345.8
FULL TENSIONER	1.2	2.5	4.6	7.5	11.2	15.8
INTERMEDIATE TENSIONER	1.0	1.0	1.2	1.3	1.6	1.8

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1040.0	SUPPORT STRUCTURE =	6.4	INTERCONNECT HARNESS =	51.7
BOX COVER =	47.4	BOX HINGE =	1.1	COVER LATCH =	23.4
CONTAINER =	87.6	MAST TIP FITTING =	3.5	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	5.8
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	6.3		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 50.0 KW ARRAY WIDTH = 8.50 M

ARRAY LENGTH = 59.30 M ASPECT RATIO = 6.98 BLANKET AREA = .78125+06 IN-SQ BLANKET WEIGHT = 1040.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.045	.054
***** TORSIONAL FREQUENCY HZ *****	.029	.059	.089	.120	.152	.185
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.045	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	657.0	732.3	809.4	888.5	969.9	1053.6
ARRAY WEIGHT (LB)	1445.4	1611.0	1780.6	1954.7	2133.8	2317.8
CENTER OF GRAVITY (IN)	1052.7	1025.7	1003.2	984.0	967.3	952.5
BLANKET TENSION (LB)	5.21	20.83	46.86	83.31	130.17	187.44
MOMENT OF INERTIA I1	.2465+10	.2673+10	.2886+10	.3105+10	.3329+10	.3560+10
MOMENT OF INERTIA I2	.1202+08	.1205+08	.1211+08	.1219+08	.1230+08	.1242+08
SPECIFIC POWER (KW/KG)	.076	.068	.062	.056	.052	.047
SPECIFIC WEIGHT (KG/KW)	13.1	14.6	16.2	17.8	19.4	21.1
* BOOM PROPERTIES *						
DIAMETER (IN)	16.63	23.68	29.20	33.94	38.19	42.12
EI (LB-IN-SQ)	.35835+08	.14719+09	.34005+09	.62073+09	.99588+09	.14724+10
ROOT SPRING (LB*IN/RAD)	.3376+06	.9742+06	.1826+07	.2867+07	.4087+07	.5480+07
BUCKLING CAPABILITY RATIO	9.53	9.40	9.22	8.97	8.62	8.21
STRENGTH CAPABILITY RATIO	1.01	2.69	4.66	6.79	9.03	11.31
* CANNISTER PROPERTIES *						
HEIGHT (IN)	78.81	90.43	99.53	107.36	114.38	120.85
DIAMETER (IN)	19.63	27.94	34.45	40.04	45.07	49.70
* WEIGHTS (LB) *						
ARRAY	1445.4	1611.0	1780.6	1954.7	2133.8	2317.8
BOOM	111.3	225.5	342.8	463.2	586.7	713.4
CANNISTER	55.6	105.7	155.9	206.8	258.6	311.5
FULL TENSIONER	1.2	2.4	4.4	7.1	10.6	14.9
INTERMEDIATE TENSIONER	1.0	1.0	1.1	1.3	1.5	1.8

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1040.0	SUPPORT STRUCTURE =	6.4	INTERCONNECT HARNESS =	51.7
BOX COVER =	47.4	BOX HINGE =	1.3	COVER LATCH =	22.3
CONTAINER =	88.8	MAST TIP FITTING =	3.5	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	5.8
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	6.0		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 50.0 KW   ARRAY WIDTH = 9.00 M

ARRAY LENGTH = 56.00 M   ASPECT RATIO = 6.22   BLANKET AREA = .78125+06 IN*SQ   BLANKET WEIGHT = 1040.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.026	.052	.080	.107	.135	.164
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	648.0	714.1	781.6	850.6	921.4	994.0
ARRAY WEIGHT (LB)	1425.7	1571.1	1719.5	1871.4	2027.1	2186.8
CENTER OF GRAVITY (IN)	996.6	972.0	951.3	933.2	917.3	903.1
BLANKET TENSION (LB)	4.92	19.67	44.26	78.68	122.94	177.03
MOMENT OF INERTIA I1	.2174+10	.2334+10	.2498+10	.2665+10	.2836+10	.3011+10
MOMENT OF INERTIA I2	.1346+08	.1350+08	.1356+08	.1364+08	.1376+08	.1389+08
SPECIFIC POWER (KW/KG)	.077	.070	.064	.059	.054	.050
SPECIFIC WEIGHT (KG/KW)	13.0	14.3	15.6	17.0	18.4	19.9
* BOOM PROPERTIES *						
DIAMETER (IN)	15.92	22.65	27.90	32.40	36.43	40.14
EI (LB*IN*SQ)	.30082+08	.12312+09	.28345+09	.51561+09	.82432+09	.12145+10
ROOT SPRING (LB*IN/RAD)	.2961+06	.8521+06	.1593+07	.2494+07	.3546+07	.4743+07
BUCKLING CAPABILITY RATIO	9.45	9.26	9.02	8.72	8.33	7.89
STRENGTH CAPABILITY RATIO	.95	2.54	4.44	6.51	8.69	10.95
* CANNISTER PROPERTIES *						
HEIGHT (IN)	74.78	85.88	94.54	101.96	108.62	114.73
DIAMETER (IN)	18.79	26.72	32.92	38.23	42.99	47.36
* WEIGHTS (LB) *						
ARRAY	1425.7	1571.1	1719.5	1871.4	2027.1	2186.8
BOOM	96.3	194.8	295.6	398.7	504.1	611.9
CANNISTER	50.8	96.5	142.2	188.3	235.1	282.6
FULL TENSIONER	1.2	2.3	4.2	6.8	10.1	14.1
INTERMEDIATE TENSIONER	1.0	1.0	1.1	1.3	1.5	1.7

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1040.0	SUPPORT STRUCTURE =	6.4	INTERCONNECT HARNESS =	51.7
BOX COVER =	47.4	BOX HINGE =	1.5	COVER LATCH =	21.3
CONTAINER =	89.9	MAST TIP FITTING =	3.5	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	5.8
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.7		

ARRAY TYPE LMSC FOLDOUT　　　POWER/WING = 50.0 KW　　　ARRAY WIDTH = 9.50 M

ARRAY LENGTH = 53.06 M　　ASPECT RATIO = 5.58　　BLANKET AREA = .78125+06 IN-SQ　　BLANKET WEIGHT = 1040.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.023	.047	.072	.097	.122	.147
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	640.7	699.2	758.7	819.6	881.8	945.4
ARRAY WEIGHT (LB)	1409.4	1538.2	1669.2	1803.0	1939.9	2079.8
CENTER OF GRAVITY (IN)	946.0	923.7	904.5	887.7	872.6	859.0
BLANKET TENSION (LB)	4.66	18.63	41.93	74.54	116.47	167.71
MOMENT OF INERTIA I1	.1934+10	.2058+10	.2186+10	.2315+10	.2448+10	.2583+10
MOMENT OF INERTIA I2	.1498+08	.1502+08	.1509+08	.1518+08	.1530+08	.1544+08
SPECIFIC POWER (KW/KG)	.078	.072	.066	.061	.057	.053
SPECIFIC WEIGHT (KG/KW)	12.8	14.0	15.2	16.4	17.6	18.9
* BOOM PROPERTIES *						
DIAMETER (IN)	15.28	21.72	26.73	31.02	34.86	38.37
EI (LB-IN-SQ)	.25504+08	.10408+09	.23892+09	.43335+09	.69081+09	.10149+10
ROOT SPRING (LB-IN/RAD)	.2616+06	.7512+06	.1401+07	.2190+07	.3106+07	.4145+07
BUCKLING CAPABILITY RATIO	9.38	9.13	8.85	8.49	8.07	7.60
STRENGTH CAPABILITY RATIO	.89	2.41	4.23	6.24	8.37	10.58
* CANNISTER PROPERTIES *						
HEIGHT (IN)	71.16	81.79	90.06	97.14	103.47	109.27
DIAMETER (IN)	18.03	25.63	31.54	36.60	41.13	45.28
* WEIGHTS (LB) *						
ARRAY	1409.4	1538.2	1669.2	1803.0	1939.9	2079.8
BOOM	84.0	169.7	257.1	346.3	437.2	529.9
CANNISTER	46.7	88.6	130.3	172.4	215.0	258.1
FULL TENSIONER	1.2	2.3	4.0	6.4	9.6	13.4
INTERMEDIATE TENSIONER	1.0	1.0	1.1	1.3	1.5	1.7

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1040.0	SUPPORT STRUCTURE =	6.4	INTERCONNECT HARNESS =	51.7
BOX COVER =	47.4	BOX HINGE =	1.8	COVER LATCH =	20.4
CONTAINER =	91.1	MAST TIP FITTING =	3.5	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	5.8
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.5		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 50.0 KW   ARRAY WIDTH =10.00 M

ARRAY LENGTH = 50.40 M   ASPECT RATIO = 5.04   BLANKET AREA = .78125+06 IN-SQ   BLANKET WEIGHT = 1040.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.021	.043	.065	.088	.110	.134
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	634.5	686.7	739.7	793.7	848.9	905.2
ARRAY WEIGHT (LB)	1396.0	1510.8	1627.4	1746.2	1867.5	1991.3
CENTER OF GRAVITY (IN)	900.2	879.9	862.3	846.5	832.3	819.4
BLANKET TENSION (LB)	4.43	17.70	39.83	70.81	110.64	159.33
MOMENT OF INERTIA I1	.1732+10	.1830+10	.1931+10	.2033+10	.2137+10	.2243+10
MOMENT OF INERTIA I2	.1659+08	.1664+08	.1670+08	.1680+08	.1692+08	.1707+08
SPECIFIC POWER (KW/KG)	.079	.073	.068	.063	.059	.055
SPECIFIC WEIGHT (KG/KW)	12.7	13.7	14.8	15.9	17.0	18.1
* BOOM PROPERTIES *						
DIAMETER (IN)	14.69	20.87	25.68	29.78	33.44	36.79
EI (LB-IN-SQ)	.21814+08	.88808+08	.20337+09	.36798+09	.58519+09	.85765+09
ROOT SPRING (LB-IN/RAD)	.2327+06	.6669+06	.1241+07	.1937+07	.2743+07	.3654+07
BUCKLING CAPABILITY RATIO	9.31	9.02	8.68	8.29	7.84	7.35
STRENGTH CAPABILITY RATIO	.84	2.29	4.03	5.97	8.04	10.21
* CANNISTER PROPERTIES *						
HEIGHT (IN)	67.90	78.09	86.02	92.79	98.83	104.36
DIAMETER (IN)	17.34	24.63	30.30	35.14	39.46	43.42
* WEIGHTS (LB) *						
ARRAY	1396.0	1510.8	1627.4	1746.2	1867.5	1991.3
BOOM	73.8	148.9	225.3	303.1	382.3	462.8
CANNISTER	43.1	81.7	120.1	158.7	197.7	237.1
FULL TENSIONER	1.2	2.2	3.8	6.2	9.2	12.8
INTERMEDIATE TENSIONER	.9	1.0	1.1	1.3	1.4	1.7

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1040.0	SUPPORT STRUCTURE =	6.4	INTERCONNECT HARNESS =	51.7
BOX COVER =	47.4	BOX HINGE =	2.0	COVER LATCH =	19.5
CONTAINER =	92.2	MAST TIP FITTING =	3.5	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	5.8
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.3		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 55.0 KW ARRAY WIDTH = 7.00 M

ARRAY LENGTH = 79.21 M ASPECT RATIO = 11.32 BLANKET AREA = .85938+06 IN=SQ BLANKET WEIGHT = 1144.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.047	.095	.147	.201	.258	.317
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.045	.053
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	793.4	949.3	1112.8	1284.6	1465.1	1654.7
ARRAY WEIGHT (LB)	1745.5	2088.5	2448.2	2826.2	3223.3	3640.4
CENTER OF GRAVITY (IN)	1387.9	1348.8	1319.7	1297.0	1278.6	1263.4
BLANKET TENSION (LB)	7.65	30.60	68.85	122.40	191.26	275.41
MOMENT OF INERTIA I1	.5228+10	.6061+10	.6936+10	.7857+10	.8824+10	.9838+10
MOMENT OF INERTIA I2	.9024+07	.9059+07	.9117+07	.9198+07	.9302+07	.9429+07
SPECIFIC POWER (KW/KG)	.069	.058	.049	.043	.038	.033
SPECIFIC WEIGHT (KG/KW)	14.4	17.3	20.2	23.4	26.6	30.1
* BOOM PROPERTIES *						
DIAMETER (IN)	21.30	30.52	37.87	44.29	50.17	55.67
EI (LB-IN-SQ)	.96350+08	.40598+09	.96216+09	.18015+10	.29643+10	.44943+10
ROOT SPRING (LB-IN/RAD)	.7090+06	.2085+07	.3983+07	.6375+07	.9261+07	.1265+08
BUCKLING CAPABILITY RATIO	9.95	10.18	10.36	10.44	10.38	10.15
STRENGTH CAPABILITY RATIO	1.33	3.37	5.62	7.93	10.24	12.54
* CANNISTER PROPERTIES *						
HEIGHT (IN)	103.75	118.96	131.08	141.69	151.38	160.45
DIAMETER (IN)	25.14	36.01	44.68	52.27	59.20	65.69
* WEIGHTS (LB) *						
ARRAY	1745.5	2088.5	2448.2	2826.2	3223.3	3640.4
BOOM	243.7	500.3	770.2	1054.0	1352.0	1664.7
CANNISTER	92.0	176.6	263.3	353.3	447.0	544.7
FULL TENSIONER	1.4	3.2	6.0	10.0	15.2	21.5
INTERMEDIATE TENSIONER	1.0	1.1	1.2	1.5	1.8	2.2

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1144.0	SUPPORT STRUCTURE =	6.9	INTERCONNECT HARNESS =	56.8
BOX COVER =	52.1	BOX HINGE =	.7	COVER LATCH =	33.7
CONTAINER =	92.3	MAST TIP FITTING =	3.6	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	6.4
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	7.6		

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE LMSC FOLDOUT POWER/WING = 55.0 KW ARRAY WIDTH = 7.50 M

ARRAY LENGTH = 73.92 M ASPECT RATIO = 9.86 BLANKET AREA = .85938+06 IN=SQ BLANKET WEIGHT = 1144.0 LB

FREQUENCY DEPENDENT PARAMETERS

/***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.041	.083	.127	.173	.221	.270
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.045	.053
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	770.6	902.5	1039.9	1183.1	1332.5	1488.5
ARRAY WEIGHT (LB)	1695.3	1985.6	2287.7	2602.8	2931.6	3274.6
CENTER OF GRAVITY (IN)	1300.1	1264.0	1236.3	1214.0	1195.6	1180.1
BLANKET TENSION (LB)	7.14	28.56	64.26	114.24	178.51	257.05
MOMENT OF INERTIA I1	.4443+10	.5046+10	.5675+10	.6332+10	.7016+10	.7730+10
MOMENT OF INERTIA I2	.1034+08	.1037+08	.1043+08	.1052+08	.1063+08	.1077+08
SPECIFIC POWER (KW/KG)	.071	.061	.053	.046	.041	.037
SPECIFIC WEIGHT (KG/KW)	14.0	16.4	18.9	21.5	24.2	27.1
* BOOM PROPERTIES *						
DIAMETER (IN)	20.19	28.86	35.74	41.72	47.15	52.22
EI (LB-IN-SQ)	.77693+08	.32468+09	.76321+09	.14174+10	.23134+10	.34794+10
ROOT SPRING (LB-IN/RAD)	.6033+06	.1763+07	.3347+07	.5325+07	.7690+07	.1044+08
BUCKLING CAPABILITY RATIO	9.83	9.94	10.01	9.98	9.81	9.51
STRENGTH CAPABILITY RATIO	1.25	3.20	5.40	7.68	10.00	12.32
* CANNISTER PROPERTIES *						
HEIGHT (IN)	97.33	111.65	122.99	132.86	141.83	150.19
DIAMETER (IN)	23.82	34.06	42.17	49.23	55.64	61.62
* WEIGHTS (LB) *						
ARRAY	1695.3	1985.6	2287.7	2602.8	2931.6	3274.6
BOOM	204.3	417.6	640.3	872.5	1114.7	1367.1
CANNISTER	82.4	157.6	234.2	313.1	394.6	479.0
FULL TENSIONER	1.4	3.0	5.7	9.4	14.2	20.1
INTERMEDIATE TENSIONER	1.0	1.1	1.2	1.5	1.7	2.1

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1144.0	SUPPORT STRUCTURE =	6.9	INTERCONNECT HARNESS =	56.8
BOX COVER =	52.1	BOX HINGE =	.9	COVER LATCH =	31.7
CONTAINER =	93.5	MAST TIP FITTING =	3.6	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	6.4
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	7.2		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 55.0 KW   ARRAY WIDTH = 8.00 M

ARRAY LENGTH = 69.30 M   ASPECT RATIO = 8.66   BLANKET AREA = .85938+06 IN-SQ   BLANKET WEIGHT = 1144.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.036	.073	.111	.151	.192	.234
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.045	.053
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	752.5	865.6	982.7	1104.1	1230.1	1360.8
ARRAY WEIGHT (LB)	1655.5	1904.4	2161.9	2429.0	2706.2	2993.7
CENTER OF GRAVITY (IN)	1222.9	1189.7	1163.5	1141.9	1123.8	1108.3
BLANKET TENSION (LB)	6.69	26.78	60.25	107.10	167.35	240.98
MOMENT OF INERTIA I1	.3828+10	.4275+10	.4738+10	.5218+10	.5716+10	.6232+10
MOMENT OF INERTIA I2	.1174+08	.1178+08	.1184+08	.1193+08	.1205+08	.1220+08
SPECIFIC POWER (KW/KG)	.073	.064	.056	.050	.045	.040
SPECIFIC WEIGHT (KG/KW)	13.7	15.7	17.9	20.1	22.4	24.7
* BOOM PROPERTIES *						
DIAMETER (IN)	19.20	27.41	33.88	39.49	44.56	49.27
EI (LB-IN-SQ)	.63601+08	.26406+09	.61669+09	.11379+10	.18453+10	.27576+10
ROOT SPRING (LB-IN/RAD)	.5192+06	.1510+07	.2853+07	.4517+07	.6490+07	.8773+07
BUCKLING CAPABILITY RATIO	9.72	9.75	9.72	9.60	9.36	9.00
STRENGTH CAPABILITY RATIO	1.17	3.04	5.17	7.42	9.73	12.05
* CANNISTER PROPERTIES *						
HEIGHT (IN)	91.71	105.25	115.93	125.18	133.55	141.32
DIAMETER (IN)	22.66	32.34	39.98	46.60	52.58	58.14
* WEIGHTS (LB) *						
ARRAY	1655.5	1904.4	2161.9	2429.0	2706.2	2993.7
BOOM	173.3	353.1	539.6	732.9	933.3	1141.0
CANNISTER	74.3	141.8	210.2	280.2	352.1	426.2
FULL TENSIONER	1.4	2.9	5.4	8.9	13.4	18.9
INTERMEDIATE TENSIONER	1.0	1.1	1.2	1.4	1.7	2.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1144.0	SUPPORT STRUCTURE =	6.9	INTERCONNECT HARNESS =	56.8
BOX COVER =	52.1	BOX HINGE =	1.2	COVER LATCH =	30.0
CONTAINER =	94.6	MAST TIP FITTING =	3.6	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	6.4
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	6.8		

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 55.0 KW   ARRAY WIDTH = 8.50 M

ARRAY LENGTH = 65.23 M   ASPECT RATIO = 7.67   BLANKET AREA = .85938+06 IN-SQ   BLANKET WEIGHT = 1144.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.045	.054
***** TORSIONAL FREQUENCY HZ *****	.032	.064	.098	.133	.168	.205
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.045	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	737.9	836.1	937.1	1041.4	1149.2	1260.5
ARRAY WEIGHT (LB)	1623.4	1839.3	2061.6	2291.1	2528.2	2773.1
CENTER OF GRAVITY (IN)	1154.3	1123.9	1099.3	1078.7	1061.1	1045.7
BLANKET TENSION (LB)	6.30	25.20	56.70	100.80	157.51	226.81
MOMENT OF INERTIA I1	.3337+10	.3674+10	.4022+10	.4381+10	.4752+10	.5134+10
MOMENT OF INERTIA I2	.1323+08	.1327+08	.1334+08	.1344+08	.1357+08	.1372+08
SPECIFIC POWER (KW/KG)	.075	.066	.059	.053	.048	.044
SPECIFIC WEIGHT (KG/KW)	13.4	15.2	17.0	18.9	20.9	22.9
* BOOM PROPERTIES *						
DIAMETER (IN)	18.32	26.12	32.25	37.54	42.30	46.71
EI (LB-IN-SQ)	.52747+08	.21786+09	.50613+09	.92903+09	.14987+10	.22282+10
ROOT SPRING (LB-IN/RAD)	.4512+06	.1307+07	.2460+07	.3879+07	.5553+07	.7476+07
BUCKLING CAPABILITY RATIO	9.63	9.58	9.47	9.28	8.97	8.57
STRENGTH CAPABILITY RATIO	1.10	2.88	4.95	7.16	9.44	11.75
* CANNISTER PROPERTIES *						
HEIGHT (IN)	86.73	99.60	109.71	118.43	126.30	133.57
DIAMETER (IN)	21.62	30.82	38.05	44.29	49.92	55.12
* WEIGHTS (LB) *						
ARRAY	1623.4	1839.3	2061.6	2291.1	2528.2	2773.1
BOOM	148.5	301.8	460.1	623.3	791.7	965.3
CANNISTER	67.5	128.6	190.1	252.9	317.1	382.8
FULL TENSIONER	1.3	2.7	5.1	8.4	12.7	17.9
INTERMEDIATE TENSIONER	1.0	1.0	1.2	1.4	1.7	2.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1144.0	SUPPORT STRUCTURE =	6.9	INTERCONNECT HARNESS =	56.8
BOX COVER =	52.1	BOX HINGE =	1.4	COVER LATCH =	28.5
CONTAINER =	95.7	MAST TIP FITTING =	3.6	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	6.4
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	6.5		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 55.0 KW   ARRAY WIDTH = 9.00 M

ARRAY LENGTH = 61.60 M   ASPECT RATIO = 6.84   BLANKET AREA = .85938+06 IN-SQ   BLANKET WEIGHT = 1144.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.045	.054
***** TORSIONAL FREQUENCY HZ *****	.028	.058	.087	.118	.150	.182
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.045	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	726.0	812.0	900.2	990.8	1084.2	1180.2
ARRAY WEIGHT (LB)	1597.2	1786.4	1980.3	2179.8	2385.2	2596.5
CENTER OF GRAVITY (IN)	1092.9	1065.2	1042.2	1022.6	1005.6	990.7
BLANKET TENSION (LB)	5.95	23.80	53.55	95.20	148.75	214.21
MOMENT OF INERTIA I1	.2937+10	.3196+10	.3462+10	.3736+10	.4018+10	.4307+10
MOMENT OF INERTIA I2	.1481+08	.1486+08	.1493+08	.1504+08	.1517+08	.1533+08
SPECIFIC POWER (KW/KG)	.076	.068	.061	.056	.051	.047
SPECIFIC WEIGHT (KG/KW)	13.2	14.8	16.4	18.0	19.7	21.5
* BOOM PROPERTIES *						
DIAMETER (IN)	17.54	24.97	30.80	35.81	40.31	44.47
EI (LB-IN-SQ)	.44246+08	.18197+09	.42095+09	.76942+09	.12360+10	.18298+10
ROOT SPRING (LB-IN/RAD)	.3955+06	.1142+07	.2142+07	.3368+07	.4806+07	.6450+07
BUCKLING CAPABILITY RATIO	9.55	9.43	9.26	9.00	8.64	8.21
STRENGTH CAPABILITY RATIO	1.03	2.74	4.73	6.89	9.13	11.43
* CANNISTER PROPERTIES *						
HEIGHT (IN)	82.29	94.56	104.17	112.44	119.87	126.73
DIAMETER (IN)	20.69	29.47	36.34	42.25	47.57	52.47
* WEIGHTS (LB) *						
ARRAY	1597.2	1786.4	1980.3	2179.8	2385.2	2596.5
BOOM	128.5	260.5	396.3	535.7	679.0	826.2
CANNISTER	61.6	117.3	173.2	229.9	287.7	346.7
FULL TENSIONER	1.3	2.6	4.9	8.0	12.0	16.9
INTERMEDIATE TENSIONER	1.0	1.0	1.2	1.4	1.6	1.9

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1144.0	SUPPORT STRUCTURE =	6.9	INTERCONNECT HARNESS =	56.8
BOX COVER =	52.1	BOX HINGE =	1.6	COVER LATCH =	27.1
CONTAINER =	96.9	MAST TIP FITTING =	3.6	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	6.4
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	6.2		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 55.0 KW   ARRAY WIDTH = 9.50 M

ARRAY LENGTH = 58.36 M   ASPECT RATIO = 6.14   BLANKET AREA = .85938+06 IN=SQ   BLANKET WEIGHT = 1144.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.045	.054
***** TORSIONAL FREQUENCY HZ *****	.026	.052	.079	.106	.134	.163
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.045	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	716.2	792.2	869.8	949.4	1031.1	1115.0
ARRAY WEIGHT (LB)	1575.6	1742.8	1913.6	2088.7	2268.5	2453.0
CENTER OF GRAVITY (IN)	1037.7	1012.4	991.0	972.5	956.2	941.7
BLANKET TENSION (LB)	5.64	22.55	50.73	90.19	140.93	202.93
MOMENT OF INERTIA I1	.2607+10	.2809+10	.3016+10	.3228+10	.3445+10	.3668+10
MOMENT OF INERTIA I2	.1649+08	.1653+08	.1661+08	.1672+08	.1686+08	.1704+08
SPECIFIC POWER (KW/KG)	.077	.069	.063	.058	.053	.049
SPECIFIC WEIGHT (KG/KW)	13.0	14.4	15.8	17.3	18.7	20.3
* BOOM PROPERTIES *						
DIAMETER (IN)	16.82	23.94	29.49	34.26	38.54	42.48
EI (LB=IN=SQ)	.37490+08	.15364+09	.35418+09	.64510+09	.10327+10	.15235+10
ROOT SPRING (LB=IN/RAD)	.3493+06	.1006+07	.1882+07	.2951+07	.4200+07	.5622+07
BUCKLING CAPABILITY RATIO	9.48	9.30	9.07	8.76	8.36	7.90
STRENGTH CAPABILITY RATIO	.97	2.60	4.52	6.62	8.83	11.09
* CANNISTER PROPERTIES *						
HEIGHT (IN)	78.31	90.05	99.22	107.09	114.14	120.64
DIAMETER (IN)	19.85	28.25	34.80	40.43	45.48	50.12
* WEIGHTS (LB) *						
ARRAY	1575.6	1742.8	1913.6	2088.7	2268.5	2453.0
BOOM	112.0	226.8	344.3	464.7	588.0	714.2
CANNISTER	56.6	107.6	158.6	210.2	262.7	316.1
FULL TENSIONER	1.3	2.6	4.7	7.6	11.4	16.1
INTERMEDIATE TENSIONER	1.0	1.0	1.2	1.3	1.6	1.9

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1144.0	SUPPORT STRUCTURE =	6.9	INTERCONNECT HARNESS =	56.8
BOX COVER =	52.1	BOX HINGE =	1.9	COVER LATCH =	25.9
CONTAINER =	98.0	MAST TIP FITTING =	3.6	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	6.4
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.9		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 55.0 KW   ARRAY WIDTH =10.00 M

ARRAY LENGTH = 55.44 M   ASPECT RATIO = 5.54   BLANKET AREA = .85938+06 IN=SQ   BLANKET WEIGHT = 1144.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.023	.047	.071	.096	.121	.147
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.046	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	708.0	775.7	844.6	915.1	987.3	1061.2
ARRAY WEIGHT (LB)	1557.7	1706.5	1858.1	2013.2	2172.1	2334.7
CENTER OF GRAVITY (IN)	987.8	964.6	944.7	927.3	911.8	897.8
BLANKET TENSION (LB)	5.36	21.42	48.20	85.68	133.88	192.79
MOMENT OF INERTIA I1	.2331+10	.2491+10	.2654+10	.2821+10	.2991+10	.3165+10
MOMENT OF INERTIA I2	.1825+08	.1830+08	.1838+08	.1850+08	.1865+08	.1883+08
SPECIFIC POWER (KW/KG)	.078	.071	.065	.060	.056	.052
SPECIFIC WEIGHT (KG/KW)	12.9	14.1	15.4	16.6	18.0	19.3
* BOOM PROPERTIES *						
DIAMETER (IN)	16.18	23.00	28.32	32.88	36.95	40.70
EI (LB-IN-SQ)	.32049+08	.13096+09	.30102+09	.54668+09	.87259+09	.12836+10
ROOT SPRING (LB-IN/RAD)	.3105+06	.8925+06	.1666+07	.2606+07	.3701+07	.4944+07
BUCKLING CAPABILITY RATIO	9.41	9.17	8.89	8.54	8.10	7.62
STRENGTH CAPABILITY RATIO	.92	2.47	4.33	6.36	8.52	10.75
* CANNISTER PROPERTIES *						
HEIGHT (IN)	74.71	85.97	94.75	102.27	108.99	115.17
DIAMETER (IN)	19.09	27.14	33.42	38.79	43.60	48.02
* WEIGHTS (LB) *						
ARRAY	1557.7	1706.5	1858.1	2013.2	2172.1	2334.7
BOOM	98.4	198.9	301.6	406.4	513.5	622.8
CANNISTER	52.2	99.1	146.0	193.3	241.3	289.9
FULL TENSIONER	1.2	2.5	4.5	7.3	10.9	15.3
INTERMEDIATE TENSIONER	1.0	1.0	1.2	1.3	1.5	1.8

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1144.0	SUPPORT STRUCTURE =	6.9	INTERCONNECT HARNESS =	56.8
BOX COVER =	52.1	BOX HINGE =	2.2	COVER LATCH =	24.8
CONTAINER =	99.1	MAST TIP FITTING =	3.6	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	6.4
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	5.7		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 60.0 KW   ARRAY WIDTH = 7.00 M

ARRAY LENGTH = 86.41 M   ASPECT RATIO = 12.34   BLANKET AREA = .93750+06 IN-SQ   BLANKET WEIGHT = 1248.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.045	.052
***** TORSIONAL FREQUENCY HZ *****	.051	.105	.162	.223	.287	.355
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.045	.052
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	895.2	1096.2	1309.0	1534.6	1773.6	2026.6
ARRAY WEIGHT (LB)	1969.5	2411.7	2879.8	3376.0	3901.9	4458.6
CENTER OF GRAVITY (IN)	1508.2	1466.9	1437.3	1414.6	1396.7	1382.0
BLANKET TENSION (LB)	9.10	36.42	81.94	145.67	227.61	327.76
MOMENT OF INERTIA I1	.6986+10	.8291+10	.9676+10	.1115+11	.1270+11	.1435+11
MOMENT OF INERTIA I2	.9866+07	.9907+07	.9976+07	.1007+08	.1020+08	.1035+08
SPECIFIC POWER (KW/KG)	.067	.055	.046	.039	.034	.030
SPECIFIC WEIGHT (KG/KW)	14.9	18.3	21.8	25.6	29.6	33.8
* BOOM PROPERTIES *						
DIAMETER (IN)	23.29	33.46	41.61	48.80	55.40	61.62
EI (LB-IN-SQ)	.13779+09	.58636+09	.14034+10	.26534+10	.44084+10	.67479+10
ROOT SPRING (LB-IN/RAD)	.9271+06	.2747+07	.5286+07	.8523+07	.1247+08	.1716+08
BUCKLING CAPABILITY RATIO	10.09	10.43	10.74	10.93	10.96	10.78
STRENGTH CAPABILITY RATIO	1.42	3.54	5.82	8.13	10.43	12.70
* CANNISTER PROPERTIES *						
HEIGHT (IN)	113.27	130.04	143.50	155.35	166.25	176.51
DIAMETER (IN)	27.49	39.48	49.10	57.58	65.37	72.71
* WEIGHTS (LB) *						
ARRAY	1969.5	2411.7	2879.8	3376.0	3901.9	4458.6
BOOM	318.0	656.0	1014.8	1395.4	1798.6	2225.2
CANNISTER	110.0	212.1	317.7	428.3	544.4	666.5
FULL TENSIONER	1.5	3.6	7.0	11.8	17.9	25.4
INTERMEDIATE TENSIONER	1.0	1.1	1.3	1.6	2.0	2.4

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1248.0	SUPPORT STRUCTURE =	7.3	INTERCONNECT HARNESS =	62.0
BOX COVER =	56.8	BOX HINGE =	.8	COVER LATCH =	42.6
CONTAINER =	99.3	MAST TIP FITTING =	3.8	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	7.0
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	8.2		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 60.0 KW   ARRAY WIDTH = 7.50 M

ARRAY LENGTH = 80.65 M   ASPECT RATIO = 10.75   BLANKET AREA = .93750+06 IN=SQ   BLANKET WEIGHT = 1248.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.044	.091	.140	.191	.245	.302
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.045	.053
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	865.7	1035.2	1213.1	1400.0	1596.4	1802.8
ARRAY WEIGHT (LB)	1904.5	2277.4	2668.7	3080.0	3512.2	3966.2
CENTER OF GRAVITY (IN)	1412.9	1374.2	1345.4	1322.8	1304.4	1289.2
BLANKET TENSION (LB)	8.50	33.99	76.48	135.96	212.44	305.91
MOMENT OF INERTIA I1	.5912+10	.6855+10	.7847+10	.8889+10	.9985+10	.1113+11
MOMENT OF INERTIA I2	.1130+08	.1134+08	.1141+08	.1152+08	.1165+08	.1181+08
SPECIFIC POWER (KW/KG)	.069	.058	.049	.043	.038	.033
SPECIFIC WEIGHT (KG/KW)	14.4	17.3	20.2	23.3	26.6	30.0
* BOOM PROPERTIES *						
DIAMETER (IN)	22.07	31.61	39.23	45.89	51.97	57.67
EI (LB-IN-SQ)	.11094+09	.46748+09	.11080+10	.20748+10	.34142+10	.51769+10
ROOT SPRING (LB-IN/RAD)	.7880+06	.2318+07	.4427+07	.7087+07	.1030+08	.1407+08
BUCKLING CAPABILITY RATIO	9.95	10.17	10.34	10.40	10.30	10.03
STRENGTH CAPABILITY RATIO	1.33	3.38	5.62	7.93	10.25	12.54
* CANNISTER PROPERTIES *						
HEIGHT (IN)	106.26	122.01	134.57	145.56	155.60	165.01
DIAMETER (IN)	26.04	37.30	46.29	54.15	61.33	68.05
* WEIGHTS (LB) *						
ARRAY	1904.5	2277.4	2668.7	3080.0	3512.2	3966.2
BOOM	266.3	546.7	841.6	1151.6	1477.3	1819.1
CANNISTER	98.4	189.0	281.9	378.4	478.9	583.6
FULL TENSIONER	1.5	3.4	6.6	11.1	16.8	23.8
INTERMEDIATE TENSIONER	1.0	1.1	1.3	1.6	1.9	2.3

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1248.0	SUPPORT STRUCTURE =	7.3	INTERCONNECT HARNESS =	62.0
BOX COVER =	56.8	BOX HINGE =	1.0	COVER LATCH =	40.1
CONTAINER =	100.4	MAST TIP FITTING =	3.8	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	7.0
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	7.7		

ORIGINAL PAGE IS
OF POOR QUALITY

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 60.0 KW   ARRAY WIDTH = 8.00 M

ARRAY LENGTH = 75.60 M   ASPECT RATIO = 9.45   BLANKET AREA = .93750+06 IN-SQ   BLANKET WEIGHT = 1248.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.039	.080	.122	.166	.212	.260
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.045	.053
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	842.2	987.2	1138.2	1295.9	1460.4	1632.2
ARRAY WEIGHT (LB)	1852.9	2171.9	2504.1	2850.9	3213.0	3590.9
CENTER OF GRAVITY (IN)	1329.1	1293.1	1265.5	1243.2	1224.9	1209.3
BLANKET TENSION (LB)	7.97	31.87	71.70	127.46	199.16	286.79
MOMENT OF INERTIA I1	.5076+10	.5773+10	.6502+10	.7262+10	.8054+10	.8881+10
MOMENT OF INERTIA I2	.1282+08	.1287+08	.1295+08	.1306+08	.1320+08	.1337+08
SPECIFIC POWER (KW/KG)	.071	.061	.053	.046	.041	.037
SPECIFIC WEIGHT (KG/KW)	14.0	16.5	19.0	21.6	24.3	27.2
* BOOM PROPERTIES *						
DIAMETER (IN)	20.98	30.00	37.16	43.38	49.04	54.32
EI (LB-IN-SQ)	.90702+08	.37926+09	.89199+09	.16575+10	.27068+10	.40733+10
ROOT SPRING (LB-IN/RAD)	.6775+06	.1981+07	.3763+07	.5988+07	.8651+07	.1175+08
BUCKLING CAPABILITY RATIO	9.83	9.95	10.01	9.96	9.77	9.44
STRENGTH CAPABILITY RATIO	1.25	3.22	5.41	7.70	10.02	12.34
* CANNISTER PROPERTIES *						
HEIGHT (IN)	100.10	114.99	126.79	137.06	146.40	155.11
DIAMETER (IN)	24.76	35.40	43.84	51.19	57.87	64.09
* WEIGHTS (LB) *						
ARRAY	1852.9	2171.9	2504.1	2850.9	3213.0	3590.9
BOOM	225.7	461.6	707.9	965.0	1233.2	1512.8
CANNISTER	88.7	169.9	252.6	337.9	426.1	517.5
FULL TENSIONER	1.5	3.2	6.2	10.4	15.8	22.4
INTERMEDIATE TENSIONER	1.0	1.1	1.3	1.5	1.8	2.2

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1248.0	SUPPORT STRUCTURE =	7.3	INTERCONNECT HARNESS =	62.0
BOX COVER =	56.8	BOX HINGE =	1.2	COVER LATCH =	37.9
CONTAINER =	101.5	MAST TIP FITTING =	3.8	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	7.0
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	7.3		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 60.0 KW   ARRAY WIDTH = 8.50 M

ARRAY LENGTH = 71.16 M   ASPECT RATIO = 8.37   BLANKET AREA = .93750+06 IN=SQ   BLANKET WEIGHT = 1248.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.035	.070	.107	.146	.186	.227
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.045	.053
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	823.4	948.8	1078.7	1213.6	1353.6	1499.1
ARRAY WEIGHT (LB)	1811.4	2087.4	2373.2	2669.9	2978.0	3298.0
CENTER OF GRAVITY (IN)	1254.8	1221.5	1195.2	1173.6	1155.5	1139.9
BLANKET TENSION (LB)	7.50	29.99	67.48	119.96	187.44	269.92
MOMENT OF INERTIA I1	.4412+10	.4938+10	.5484+10	.6050+10	.6638+10	.7248+10
MOMENT OF INERTIA I2	.1445+08	.1450+08	.1458+08	.1470+08	.1485+08	.1503+08
SPECIFIC POWER (KW/KG)	.073	.063	.056	.049	.044	.040
SPECIFIC WEIGHT (KG/KW)	13.7	15.8	18.0	20.2	22.6	25.0
* BOOM PROPERTIES *						
DIAMETER (IN)	20.02	28.58	35.34	41.20	46.50	51.42
EI (LB=IN=SQ)	.75148+08	.31227+09	.72990+09	.13479+10	.21877+10	.32720+10
ROOT SPRING (LB=IN/RAD)	.5884+06	.1712+07	.3237+07	.5128+07	.7374+07	.9973+07
BUCKLING CAPABILITY RATIO	9.73	9.76	9.73	9.60	9.34	8.95
STRENGTH CAPABILITY RATIO	1.18	3.06	5.20	7.46	9.77	12.09
* CANNISTER PROPERTIES *						
HEIGHT (IN)	94.66	108.79	119.94	129.61	138.35	146.48
DIAMETER (IN)	23.62	33.73	41.70	48.61	54.87	60.68
* WEIGHTS (LB) *						
ARRAY	1811.4	2087.4	2373.2	2669.9	2978.0	3298.0
BOOM	193.4	394.2	602.7	819.0	1043.4	1276.1
CANNISTER	80.5	153.9	228.2	304.4	382.8	463.5
FULL TENSIONER	1.4	3.1	5.9	9.9	14.9	21.1
INTERMEDIATE TENSIONER	1.0	1.1	1.2	1.5	1.8	2.2

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1248.0	SUPPORT STRUCTURE =	7.3	INTERCONNECT HARNESS =	62.0
BOX COVER =	56.8	BOX HINGE =	1.5	COVER LATCH =	35.9
CONTAINER =	102.7	MAST TIP FITTING =	3.8	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	7.0
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	6.9		

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE LMSC FOLDOUT POWER/WING = 60.0 KW ARRAY WIDTH = 9.00 M

ARRAY LENGTH = 67.20 M ASPECT RATIO = 7.47 BLANKET AREA = .93750+06 IN=SQ BLANKET WEIGHT = 1248.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.031	.063	.096	.130	.165	.201
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.045	.053
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	808.0	917.6	1030.6	1147.4	1268.2	1393.1
ARRAY WEIGHT (LB)	1777.5	2018.8	2267.4	2524.4	2790.1	3064.9
CENTER OF GRAVITY (IN)	1188.4	1157.7	1132.8	1112.1	1094.3	1078.9
BLANKET TENSION (LB)	7.08	28.32	63.73	113.30	177.03	254.92
MOMENT OF INERTIA I1	.3874+10	.4278+10	.4695+10	.5125+10	.5570+10	.6029+10
MOMENT OF INERTIA I2	.1618+08	.1623+08	.1632+08	.1644+08	.1660+08	.1679+08
SPECIFIC POWER (KW/KG)	.074	.065	.058	.052	.047	.043
SPECIFIC WEIGHT (KG/KW)	13.5	15.3	17.2	19.1	21.1	23.2
* BOOM PROPERTIES *						
DIAMETER (IN)	19.15	27.31	33.73	39.27	44.27	48.89
EI (LB-IN-SQ)	.62986+08	.26041+09	.60560+09	.11127+10	.17969+10	.26742+10
ROOT SPRING (LB-IN/RAD)	.5154+06	.1494+07	.2814+07	.4441+07	.6362+07	.8573+07
BUCKLING CAPABILITY RATIO	9.65	9.60	9.50	9.29	8.97	8.54
STRENGTH CAPABILITY RATIO	1.11	2.91	4.99	7.21	9.50	11.82
* CANNISTER PROPERTIES *						
HEIGHT (IN)	89.81	103.27	113.86	123.00	131.25	138.88
DIAMETER (IN)	22.60	32.23	39.80	46.34	52.23	57.69
* WEIGHTS (LB) *						
ARRAY	1777.5	2018.8	2267.4	2524.4	2790.1	3064.9
BOOM	167.2	340.0	518.5	702.8	893.1	1089.5
CANNISTER	73.5	140.2	207.6	276.3	346.6	418.8
FULL TENSIONER	1.4	3.0	5.6	9.4	14.1	20.0
INTERMEDIATE TENSIONER	1.0	1.1	1.2	1.4	1.7	2.1

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1248.0	SUPPORT STRUCTURE =	7.3	INTERCONNECT HARNESS =	62.0
BOX COVER =	56.8	BOX HINGE =	1.8	COVER LATCH =	34.1
CONTAINER =	103.8	MAST TIP FITTING =	3.8	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	7.0
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	6.6		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 60.0 KW   ARRAY WIDTH = 9.50 M

ARRAY LENGTH = 63.67 M   ASPECT RATIO = 6.70   BLANKET AREA = .93750+06 IN*SQ   BLANKET WEIGHT = 1248.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.045	.054
***** TORSIONAL FREQUENCY HZ *****	.028	.057	.086	.116	.147	.179
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.045	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	795.3	892.0	991.2	1093.5	1198.8	1307.3
ARRAY WEIGHT (LB)	1749.6	1962.3	2180.7	2405.6	2637.3	2876.1
CENTER OF GRAVITY (IN)	1128.6	1100.3	1077.0	1057.2	1040.0	1024.9
BLANKET TENSION (LB)	6.71	26.83	60.38	107.34	167.71	241.51
MOMENT OF INERTIA I1	.3432+10	.3747+10	.4070+10	.4403+10	.4746+10	.5098+10
MOMENT OF INERTIA I2	.1800+08	.1806+08	.1815+08	.1828+08	.1845+08	.1865+08
SPECIFIC POWER (KW/KG)	.075	.067	.061	.055	.050	.046
SPECIFIC WEIGHT (KG/KW)	13.3	14.9	16.5	18.2	20.0	21.8
* BOOM PROPERTIES *						
DIAMETER (IN)	18.37	26.17	32.29	37.55	42.29	46.66
EI (LB*IN*SQ)	.53332+08	.21958+09	.50851+09	.93048+09	.14964+10	.22177+10
ROOT SPRING (LB*IN/RAD)	.4550+06	.1315+07	.2469+07	.3884+07	.5546+07	.7450+07
BUCKLING CAPABILITY RATIO	9.57	9.46	9.29	9.02	8.65	8.19
STRENGTH CAPABILITY RATIO	1.05	2.78	4.79	6.96	9.22	11.52
* CANNISTER PROPERTIES *						
HEIGHT (IN)	85.46	98.33	108.42	117.10	124.92	132.13
DIAMETER (IN)	21.68	30.88	38.10	44.31	49.90	55.06
* WEIGHTS (LB) *						
ARRAY	1749.6	1962.3	2180.7	2405.6	2637.3	2876.1
BOOM	145.8	295.8	450.1	608.9	772.1	940.0
CANNISTER	67.5	128.6	190.0	252.4	316.0	381.1
FULL TENSIONER	1.4	2.9	5.4	8.9	13.4	19.0
INTERMEDIATE TENSIONER	1.0	1.1	1.2	1.4	1.7	2.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1248.0	SUPPORT STRUCTURE =	7.3	INTERCONNECT HARNESS =	62.0
BOX COVER =	56.8	BOX HINGE =	2.0	COVER LATCH =	32.6
CONTAINER =	104.9	MAST TIP FITTING =	3.8	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	7.0
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	6.3		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 60.0 KW   ARRAY WIDTH =10.00 M

ARRAY LENGTH = 60.48 M   ASPECT RATIO = 6.05   BLANKET AREA = .93750+06 IN=SQ   BLANKET WEIGHT = 1248.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.045	.054
***** TORSIONAL FREQUENCY HZ *****	.025	.051	.078	.105	.133	.161
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.045	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	784.7	870.6	958.5	1048.8	1141.6	1236.9
ARRAY WEIGHT (LB)	1726.3	1915.3	2108.8	2307.4	2511.5	2721.2
CENTER OF GRAVITY (IN)	1074.5	1048.5	1026.6	1007.8	991.2	976.6
BLANKET TENSION (LB)	6.37	25.49	57.36	101.97	159.33	229.43
MOMENT OF INERTIA I1	.3064+10	.3313+10	.3567+10	.3828+10	.4096+10	.4371+10
MOMENT OF INERTIA I2	.1992+08	.1998+08	.2008+08	.2022+08	.2040+08	.2061+08
SPECIFIC POWER (KW/KG)	.076	.069	.063	.057	.053	.049
SPECIFIC WEIGHT (KG/KW)	13.1	14.5	16.0	17.5	19.0	20.6
* BOOM PROPERTIES *						
DIAMETER (IN)	17.66	25.14	30.99	36.01	40.51	44.66
EI (LB-IN-SQ)	.45567+08	.18696+09	.43147+09	.78677+09	.12609+10	.18623+10
ROOT SPRING (LB=IN/RAD)	.4043+06	.1166+07	.2182+07	.3425+07	.4878+07	.6535+07
BUCKLING CAPABILITY RATIO	9.50	9.33	9.10	8.78	8.37	7.89
STRENGTH CAPABILITY RATIO	.99	2.65	4.60	6.71	8.93	11.21
* CANNISTER PROPERTIES *						
HEIGHT (IN)	81.53	93.87	103.52	111.80	119.24	126.08
DIAMETER (IN)	20.84	29.67	36.56	42.49	47.81	52.70
* WEIGHTS (LB) *						
ARRAY	1726.3	1915.3	2108.8	2307.4	2511.5	2721.2
BOOM	128.0	259.3	393.9	531.9	673.3	818.3
CANNISTER	62.2	118.4	174.8	231.8	289.9	349.0
FULL TENSIONER	1.3	2.8	5.2	8.5	12.8	18.1
INTERMEDIATE TENSIONER	1.0	1.0	1.2	1.4	1.7	2.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1248.0	SUPPORT STRUCTURE =	7.3	INTERCONNECT HARNESS =	62.0
BOX COVER =	56.8	BOX HINGE =	2.3	COVER LATCH =	31.2
CONTAINER =	106.1	MAST TIP FITTING =	3.8	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	7.0
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	6.1		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 65.0 KW ARRAY WIDTH = 7.00 M

ARRAY LENGTH = 93.61 M ASPECT RATIO = 13.37 BLANKET AREA = .10156+07 IN=SQ BLANKET WEIGHT = 1352.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
***** TORSIONAL FREQUENCY HZ *****	.055	.115	.178	.246	.319	.397
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	1005.0	1259.8	1532.3	1823.9	2135.7	2468.5
ARRAY WEIGHT (LB)	2211.0	2771.6	3371.1	4012.6	4698.4	5430.6
CENTER OF GRAVITY (IN)	1627.7	1585.1	1555.6	1533.6	1516.5	1502.7
BLANKET TENSION (LB)	10.69	42.74	96.17	170.96	267.13	384.66
MOMENT OF INERTIA I1	.9160+10	.1114+11	.1326+11	.1553+11	.1796+11	.2055+11
MOMENT OF INERTIA I2	.1072+08	.1077+08	.1085+08	.1096+08	.1110+08	.1128+08
SPECIFIC POWER (KW/KG)	.065	.052	.042	.036	.030	.026
SPECIFIC WEIGHT (KG/KW)	15.5	19.4	23.6	28.1	32.9	38.0
* BOOM PROPERTIES *						
DIAMETER (IN)	25.30	36.44	45.44	53.43	60.82	67.82
EI (LB=IN=SQ)	.19181+09	.82504+09	.19958+10	.38134+10	.64019+10	.99001+10
ROOT SPRING (LB=IN/RAD)	.1188+07	.3549+07	.6883+07	.1119+08	.1650+08	.2288+08
BUCKLING CAPABILITY RATIO	10.22	10.71	11.15	11.47	11.59	11.46
STRENGTH CAPABILITY RATIO	1.51	3.68	5.98	8.29	10.56	12.78
* CANNISTER PROPERTIES *						
HEIGHT (IN)	122.82	141.20	156.06	169.23	181.42	192.98
DIAMETER (IN)	29.86	43.00	53.62	63.04	71.76	80.03
* WEIGHTS (LB) *						
ARRAY	2211.0	2771.6	3371.1	4012.6	4698.4	5430.6
BOOM	406.4	842.9	1311.0	1812.2	2348.1	2920.0
CANNISTER	129.7	251.3	378.5	512.8	655.2	806.1
FULL TENSIONER	1.7	4.1	8.1	13.7	20.9	29.7
INTERMEDIATE TENSIONER	1.0	1.1	1.4	1.7	2.2	2.7

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1352.0	SUPPORT STRUCTURE =	7.7	INTERCONNECT HARNESS =	67.2
BOX COVER =	61.6	BOX HINGE =	.8	COVER LATCH =	53.2
CONTAINER =	106.2	MAST TIP FITTING =	3.9	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	7.5
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	8.7		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 65.0 KW ARRAY WIDTH = 7.50 M

ARRAY LENGTH = 87.37 M ASPECT RATIO = 11.65 BLANKET AREA = .10156+07 IN=SQ BLANKET WEIGHT = 1352.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
***** TORSIONAL FREQUENCY HZ *****	.048	.099	.153	.210	.271	.335
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	967.5	1181.7	1408.3	1648.5	1902.8	2171.9
ARRAY WEIGHT (LB)	2128.4	2599.7	3098.3	3626.6	4186.2	4778.3
CENTER OF GRAVITY (IN)	1524.9	1484.3	1455.0	1432.5	1414.6	1400.0
BLANKET TENSION (LB)	9.97	39.89	89.75	159.56	249.32	359.02
MOMENT OF INERTIA I1	.7718+10	.9143+10	.1066+11	.1226+11	.1396+11	.1575+11
MOMENT OF INERTIA I2	.1227+08	.1232+08	.1241+08	.1253+08	.1268+08	.1287+08
SPECIFIC POWER (KW/KG)	.067	.055	.046	.039	.034	.030
SPECIFIC WEIGHT (KG/KW)	14.9	18.2	21.7	25.4	29.3	33.4
* BOOM PROPERTIES *						
DIAMETER (IN)	23.96	34.40	42.78	50.16	56.93	63.32
EI (LB-IN-SQ)	.15417+09	.65554+09	.15678+10	.29620+10	.49175+10	.75217+10
ROOT SPRING (LB-IN/RAD)	.1009+07	.2987+07	.5744+07	.9256+07	.1354+08	.1862+08
BUCKLING CAPABILITY RATIO	10.07	10.41	10.69	10.85	10.82	10.59
STRENGTH CAPABILITY RATIO	1.42	3.53	5.81	8.12	10.42	12.69
* CANNISTER PROPERTIES *						
HEIGHT (IN)	115.20	132.43	146.26	158.43	169.61	180.14
DIAMETER (IN)	28.27	40.59	50.48	59.19	67.18	74.71
* WEIGHTS (LB) *						
ARRAY	2128.4	2599.7	3098.3	3626.6	4186.2	4778.3
BOOM	340.1	701.3	1084.5	1490.7	1920.7	2375.5
CANNISTER	115.9	223.6	335.1	451.7	574.0	702.6
FULL TENSIONER	1.6	3.9	7.6	12.8	19.5	27.8
INTERMEDIATE TENSIONER	1.0	1.1	1.3	1.7	2.1	2.6

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1352.0	SUPPORT STRUCTURE =	7.7	INTERCONNECT HARNESS =	67.2
BOX COVER =	61.6	BOX HINGE =	1.1	COVER LATCH =	49.9
CONTAINER =	107.4	MAST TIP FITTING =	3.9	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	7.5
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	8.2		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 65.0 KW   ARRAY WIDTH = 8.00 M

ARRAY LENGTH = 81.91 M   ASPECT RATIO = 10.24   BLANKET AREA = .10156+07 IN*SQ   BLANKET WEIGHT = 1352.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.042	.087	.133	.182	.234	.287
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.045	.053
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	937.7	1120.4	1312.1	1513.5	1725.2	1947.7
ARRAY WEIGHT (LB)	2063.0	2464.9	2886.5	3329.7	3795.5	4284.9
CENTER OF GRAVITY (IN)	1434.6	1396.3	1367.7	1345.2	1327.0	1311.8
BLANKET TENSION (LB)	9.35	37.40	84.14	149.59	233.74	336.58
MOMENT OF INERTIA I1	.6603+10	.7655+10	.8762+10	.9925+10	.1115+11	.1243+11
MOMENT OF INERTIA I2	.1392+08	.1398+08	.1407+08	.1420+08	.1436+08	.1457+08
SPECIFIC POWER (KW/KG)	.069	.058	.050	.043	.038	.033
SPECIFIC WEIGHT (KG/KW)	14.4	17.2	20.2	23.3	26.5	30.0
* BOOM PROPERTIES *						
DIAMETER (IN)	22.77	32.63	40.48	47.36	53.64	59.52
EI (LB*IN*SQ)	.12588+09	.53040+09	.12571+10	.23538+10	.38730+10	.58722+10
ROOT SPRING (LB*IN/RAD)	.8663+06	.2548+07	.4867+07	.7790+07	.1132+08	.1546+08
BUCKLING CAPABILITY RATIO	9.94	10.16	10.31	10.35	10.21	9.91
STRENGTH CAPABILITY RATIO	1.33	3.37	5.62	7.93	10.24	12.54
* CANNISTER PROPERTIES *						
HEIGHT (IN)	108.52	124.78	137.74	149.08	159.44	169.14
DIAMETER (IN)	26.87	38.50	47.77	55.88	63.29	70.23
* WEIGHTS (LB) *						
ARRAY	2063.0	2464.9	2886.5	3329.7	3795.5	4284.9
BOOM	288.1	591.4	910.4	1245.8	1598.0	1967.7
CANNISTER	104.5	200.8	299.7	402.3	509.2	620.7
FULL TENSIONER	1.6	3.7	7.2	12.1	18.4	26.1
INTERMEDIATE TENSIONER	1.0	1.1	1.3	1.6	2.0	2.5

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1352.0	SUPPORT STRUCTURE =	7.7	INTERCONNECT HARNESS =	67.2
BOX COVER =	61.6	BOX HINGE =	1.3	COVER LATCH =	47.1
CONTAINER =	108.5	MAST TIP FITTING =	3.9	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	7.5
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	7.8		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 65.0 KW   ARRAY WIDTH = 8.50 M

ARRAY LENGTH = 77.09 M   ASPECT RATIO = 9.07   BLANKET AREA = .10156+07 IN-SQ   BLANKET WEIGHT = 1352.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.037	.076	.117	.160	.204	.250
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.045	.053
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	913.8	1071.5	1235.8	1407.4	1586.6	1773.8
ARRAY WEIGHT (LB)	2010.4	2357.2	2718.7	3096.2	3490.6	3902.4
CENTER OF GRAVITY (IN)	1354.5	1318.7	1291.2	1269.0	1250.7	1235.2
BLANKET TENSION (LB)	8.80	35.20	79.20	140.79	219.99	316.78
MOMENT OF INERTIA I1	.5722+10	.6514+10	.7342+10	.8206+10	.9108+10	.1005+11
MOMENT OF INERTIA I2	.1568+08	.1574+08	.1584+08	.1598+08	.1615+08	.1637+08
SPECIFIC POWER (KW/KG)	.071	.061	.053	.046	.041	.037
SPECIFIC WEIGHT (KG/KW)	14.1	16.5	19.0	21.7	24.4	27.3
* BOOM PROPERTIES *						
DIAMETER (IN)	21.72	31.06	38.47	44.92	50.79	56.26
EI (LB-IN-SQ)	.10418+09	.43578+09	.10253+10	.19060+10	.31137+10	.46874+10
ROOT SPRING (LB-IN/RAD)	.7517+06	.2199+07	.4177+07	.6650+07	.9609+07	.1306+08
BUCKLING CAPABILITY RATIO	9.84	9.95	10.00	9.94	9.72	9.35
STRENGTH CAPABILITY RATIO	1.26	3.22	5.42	7.71	10.03	12.35
* CANNISTER PROPERTIES *						
HEIGHT (IN)	102.61	118.02	130.25	140.89	150.57	159.59
DIAMETER (IN)	25.63	36.66	45.40	53.01	59.93	66.38
* WEIGHTS (LB) *						
ARRAY	2010.4	2357.2	2718.7	3096.2	3490.6	3902.4
BOOM	246.7	504.5	773.9	1055.1	1348.6	1654.6
CANNISTER	94.8	181.7	270.3	361.7	456.3	554.3
FULL TENSIONER	1.5	3.5	6.8	11.4	17.3	24.6
INTERMEDIATE TENSIONER	1.0	1.1	1.3	1.6	1.9	2.4

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1352.0	SUPPORT STRUCTURE =	7.7	INTERCONNECT HARNESS =	67.2
BOX COVER =	61.6	BOX HINGE =	1.6	COVER LATCH =	44.6
CONTAINER =	109.6	MAST TIP FITTING =	3.9	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	7.5
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	7.4		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 65.0 KW   ARRAY WIDTH = 9.00 M

ARRAY LENGTH = 72.80 M   ASPECT RATIO = 8.09   BLANKET AREA = .10156+07 IN*SQ   BLANKET WEIGHT = 1352.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.033	.068	.104	.141	.180	.220
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.045	.053
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	894.3	1031.8	1174.3	1322.4	1476.2	1636.2
ARRAY WEIGHT (LB)	1967.4	2269.9	2583.5	2909.2	3247.7	3599.5
CENTER OF GRAVITY (IN)	1283.0	1249.6	1223.4	1201.8	1183.6	1168.1
BLANKET TENSION (LB)	8.31	33.24	74.80	132.97	207.77	299.18
MOMENT OF INERTIA I1	.5012+10	.5619+10	.6250+10	.6905+10	.7585+10	.8291+10
MOMENT OF INERTIA I2	.1755+08	.1761+08	.1772+08	.1786+08	.1805+08	.1828+08
SPECIFIC POWER (KW/KG)	.073	.063	.055	.049	.044	.040
SPECIFIC WEIGHT (KG/KW)	13.8	15.9	18.1	20.3	22.7	25.2
* BOOM PROPERTIES *						
DIAMETER (IN)	20.78	29.67	36.69	42.78	48.30	53.42
EI (LB*IN*SQ)	.87241+08	.36276+09	.84847+09	.15679+10	.25464+10	.38111+10
ROOT SPRING (LB*IN/RAD)	.6581+06	.1916+07	.3624+07	.5744+07	.8264+07	.1118+08
BUCKLING CAPABILITY RATIO	9.74	9.77	9.74	9.59	9.30	8.89
STRENGTH CAPABILITY RATIO	1.19	3.08	5.23	7.49	9.80	12.12
* CANNISTER PROPERTIES *						
HEIGHT (IN)	97.34	112.02	123.60	133.65	142.75	151.20
DIAMETER (IN)	24.52	35.01	43.30	50.48	56.99	63.04
* WEIGHTS (LB) *						
ARRAY	1967.4	2269.9	2583.5	2909.2	3247.7	3599.5
BOOM	213.2	434.7	664.9	903.8	1151.8	1409.1
CANNISTER	86.5	165.5	245.6	327.7	412.3	499.6
FULL TENSIONER	1.5	3.4	6.5	10.8	16.4	23.3
INTERMEDIATE TENSIONER	1.0	1.1	1.3	1.5	1.9	2.3

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1352.0	SUPPORT STRUCTURE =	7.7	INTERCONNECT HARNESS =	67.2
BOX COVER =	61.6	BOX HINGE =	1.9	COVER LATCH =	42.4
CONTAINER =	110.8	MAST TIP FITTING =	3.9	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	7.5
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	7.1		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 65.0 KW   ARRAY WIDTH = 9.50 M

ARRAY LENGTH = 68.97 M   ASPECT RATIO = 7.26   BLANKET AREA = .10156+07 IN-SQ   BLANKET WEIGHT = 1352.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.030	.061	.093	.126	.161	.196
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.045	.053
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	878.2	999.2	1124.1	1253.2	1386.9	1525.2
ARRAY WEIGHT (LB)	1932.0	2198.2	2472.9	2757.1	3051.2	3355.5
CENTER OF GRAVITY (IN)	1218.6	1187.7	1162.8	1141.9	1124.1	1108.7
BLANKET TENSION (LB)	7.87	31.49	70.86	125.97	196.83	283.44
MOMENT OF INERTIA I1	.4431+10	.4904+10	.5392+10	.5898+10	.6420+10	.6959+10
MOMENT OF INERTIA I2	.1953+08	.1959+08	.1970+08	.1986+08	.2005+08	.2029+08
SPECIFIC POWER (KW/KG)	.074	.065	.058	.052	.047	.043
SPECIFIC WEIGHT (KG/KW)	13.5	15.4	17.3	19.3	21.3	23.5
* BOOM PROPERTIES *						
DIAMETER (IN)	19.93	28.42	35.11	40.88	46.10	50.92
EI (LB-IN-SQ)	.73815+08	.30544+09	.71090+09	.13073+10	.21129+10	.31470+10
ROOT SPRING (LB-IN/RAD)	.5805+06	.1684+07	.3174+07	.5012+07	.7184+07	.9686+07
BUCKLING CAPABILITY RATIO	9.66	9.62	9.51	9.29	8.95	8.50
STRENGTH CAPABILITY RATIO	1.12	2.94	5.03	7.26	9.55	11.87
* CANNISTER PROPERTIES *						
HEIGHT (IN)	92.62	106.64	117.67	127.20	135.80	143.76
DIAMETER (IN)	23.52	33.54	41.43	48.24	54.39	60.09
* WEIGHTS (LB) *						
ARRAY	1932.0	2198.2	2472.9	2757.1	3051.2	3355.5
BOOM	185.8	377.9	576.5	781.8	994.0	1213.1
CANNISTER	79.4	151.6	224.5	299.0	375.3	453.7
FULL TENSIONER	1.5	3.2	6.2	10.3	15.6	22.1
INTERMEDIATE TENSIONER	1.0	1.1	1.3	1.5	1.8	2.2

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1352.0	SUPPORT STRUCTURE =	7.7	INTERCONNECT HARNESS =	67.2
BOX COVER =	61.6	BOX HINGE =	2.2	COVER LATCH =	40.4
CONTAINER =	111.9	MAST TIP FITTING =	3.9	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	7.5
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	6.8		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 65.0 KW ARRAY WIDTH =10.00 M

ARRAY LENGTH = 65.52 M ASPECT RATIO = 6.55 BLANKET AREA = .10156+07 IN=SQ BLANKET WEIGHT = 1352.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.045	.054
***** TORSIONAL FREQUENCY HZ *****	.027	.055	.084	.114	.144	.176
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.045	.054
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	864.8	972.1	1082.5	1196.2	1313.5	1434.5
ARRAY WEIGHT (LB)	1902.5	2138.6	2381.4	2631.6	2889.7	3155.9
CENTER OF GRAVITY (IN)	1160.4	1131.8	1108.2	1088.2	1070.9	1055.7
BLANKET TENSION (LB)	7.48	29.92	67.32	119.67	186.99	269.26
MOMENT OF INERTIA I1	.3949+10	.4322+10	.4706+10	.5101+10	.5509+10	.5928+10
MOMENT OF INERTIA I2	.2161+08	.2168+08	.2180+08	.2196+08	.2216+08	.2242+08
SPECIFIC POWER (KW/KG)	.075	.067	.060	.054	.049	.045
SPECIFIC WEIGHT (KG/KW)	13.3	15.0	16.7	18.4	20.2	22.1
* BOOM PROPERTIES *						
DIAMETER (IN)	19.16	27.29	33.68	39.18	44.13	48.70
EI (LB-IN-SQ)	.63030+08	.25975+09	.60211+09	.11028+10	.17751+10	.26332+10
ROOT SPRING (LB-IN/RAD)	.5157+06	.1492+07	.2802+07	.4412+07	.6304+07	.8474+07
BUCKLING CAPABILITY RATIO	9.58	9.48	9.31	9.03	8.64	8.17
STRENGTH CAPABILITY RATIO	1.06	2.81	4.84	7.02	9.29	11.59
* CANNISTER PROPERTIES *						
HEIGHT (IN)	88.36	101.79	112.32	121.40	129.57	137.11
DIAMETER (IN)	22.61	32.21	39.74	46.23	52.07	57.47
* WEIGHTS (LB) *						
ARRAY	1902.5	2138.6	2381.4	2631.6	2889.7	3155.9
BOOM	163.1	331.1	504.1	682.2	865.5	1054.1
CANNISTER	73.2	139.5	206.4	274.3	343.7	414.8
FULL TENSIONER	1.4	3.1	5.9	9.8	14.9	21.0
INTERMEDIATE TENSIONER	1.0	1.1	1.2	1.5	1.8	2.2

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1352.0	SUPPORT STRUCTURE =	7.7	INTERCONNECT HARNESS =	67.2
BOX COVER =	61.6	BOX HINGE =	2.5	COVER LATCH =	38.6
CONTAINER =	113.0	MAST TIP FITTING =	3.9	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	7.5
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	6.5		

ARRAY TYPE LMSC FOLDOUT | POWER/WING = 70.0 KW | ARRAY WIDTH = 7.00 M

ARRAY LENGTH =100.81 M | ASPECT RATIO = 14.40 | BLANKET AREA = .10938+07 IN-SQ | BLANKET WEIGHT = 1456.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
***** TORSIONAL FREQUENCY HZ *****	.060	.125	.195	.271	.353	.441
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
*** ARRAY PROPERTIES ***						
ARRAY MASS (KG)	1123.5	1442.0	1786.3	2158.3	2559.8	2992.1
ARRAY WEIGHT (LB)	2471.7	3172.4	3929.8	4748.3	5631.5	6582.6
CENTER OF GRAVITY (IN)	1746.6	1703.6	1674.9	1654.0	1638.0	1625.3
BLANKET TENSION (LB)	12.39	49.57	111.53	198.27	309.80	446.12
MOMENT OF INERTIA I1	.1182+11	.1473+11	.1789+11	.2131+11	.2490+11	.2896+11
MOMENT OF INERTIA I2	.1158+08	.1164+08	.1173+08	.1186+08	.1203+08	.1224+08
SPECIFIC POWER (KW/KG)	.062	.049	.039	.032	.027	.023
SPECIFIC WEIGHT (KG/KW)	16.0	20.6	25.5	30.8	36.6	42.7
*** BOOM PROPERTIES ***						
DIAMETER (IN)	27.33	39.47	49.36	58.20	66.43	74.28
EI (LB-IN-SQ)	.26098+09	.11356+10	.27786+10	.53697+10	.91150+10	.14250+11
ROOT SPRING (LB-IN/RAD)	.1497+07	.4510+07	.8823+07	.1446+08	.2151+08	.3007+08
BUCKLING CAPABILITY RATIO	10.37	11.00	11.59	12.06	12.29	12.20
STRENGTH CAPABILITY RATIO	1.58	3.80	6.11	8.39	10.63	12.81
*** CANNISTER PROPERTIES ***						
HEIGHT (IN)	132.40	152.43	168.76	183.34	196.93	209.88
DIAMETER (IN)	32.25	46.57	58.25	68.68	78.39	87.65
*** WEIGHTS (LB) ***						
ARRAY	2471.7	3172.4	3929.8	4748.3	5631.5	6582.6
BOOM	510.6	1065.0	1665.9	2315.9	3017.3	3772.6
CANNISTER	151.2	294.6	446.1	607.7	780.6	965.6
FULL TENSIONER	1.8	4.6	9.2	15.7	24.1	34.3
INTERMEDIATE TENSIONER	1.0	1.2	1.4	1.8	2.3	3.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1456.0	SUPPORT STRUCTURE =	8.2	INTERCONNECT HARNESS =	72.4
BOX COVER =	66.3	BOX HINGE =	.9	COVER LATCH =	65.5
CONTAINER =	113.2	MAST TIP FITTING =	4.1	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	8.1
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	9.3		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 70.0 KW   ARRAY WIDTH = 7.50 M

ARRAY LENGTH = 94.09 M   ASPECT RATIO = 12.54   BLANKET AREA = .10938+07 IN=SQ   BLANKET WEIGHT = 1456.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
***** TORSIONAL FREQUENCY HZ *****	.052	.108	.167	.231	.298	.371
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	1076.6	1343.4	1628.3	1932.8	2257.8	2604.4
ARRAY WEIGHT (LB)	2368.5	2955.5	3582.3	4252.1	4967.2	5729.7
CENTER OF GRAVITY (IN)	1636.1	1594.4	1565.3	1543.4	1526.3	1512.5
BLANKET TENSION (LB)	11.57	46.26	104.09	185.06	289.15	416.38
MOMENT OF INERTIA I1	.9914+10	.1201+11	.1425+11	.1665+11	.1921+11	.2194+11
MOMENT OF INERTIA I2	.1325+08	.1331+08	.1341+08	.1355+08	.1373+08	.1395+08
SPECIFIC POWER (KW/KG)	.065	.052	.043	.036	.031	.027
SPECIFIC WEIGHT (KG/KW)	15.4	19.2	23.3	27.6	32.3	37.2
* BOOM PROPERTIES *						
DIAMETER (IN)	25.86	37.23	46.41	54.54	62.06	69.17
EI (LB-IN-SQ)	.20937+09	.89900+09	.21709+10	.41411+10	.69403+10	.10715+11
ROOT SPRING (LB-IN/RAD)	.1269+07	.3785+07	.7332+07	.1190+08	.1753+08	.2428+08
BUCKLING CAPABILITY RATIO	10.20	10.65	11.06	11.33	11.39	11.19
STRENGTH CAPABILITY RATIO	1.49	3.66	5.96	8.27	10.54	12.77
* CANNISTER PROPERTIES *						
HEIGHT (IN)	124.16	142.92	158.07	171.48	183.88	195.63
DIAMETER (IN)	30.52	43.93	54.76	64.36	73.23	81.62
* WEIGHTS (LB) *						
ARRAY	2368.5	2955.5	3582.3	4252.1	4967.2	5729.7
BOOM	426.8	884.4	1374.4	1898.2	2457.4	3053.4
CANNISTER	135.0	261.7	393.9	533.5	681.1	837.5
FULL TENSIONER	1.7	4.3	8.7	14.7	22.5	32.1
INTERMEDIATE TENSIONER	1.0	1.1	1.4	1.8	2.3	2.8

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1456.0	SUPPORT STRUCTURE =	8.2	INTERCONNECT HARNESS =	72.4
BOX COVER =	66.3	BOX HINGE =	1.1	COVER LATCH =	61.4
CONTAINER =	114.3	MAST TIP FITTING =	4.1	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	8.1
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	8.8		

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE LMSC FOLDOUT POWER/WING = 70.0 KW ARRAY WIDTH = 8.00 M

ARRAY LENGTH = 88.21 M ASPECT RATIO = 11.03 BLANKET AREA = .10938+07 IN-SQ BLANKET WEIGHT = 1456.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
***** TORSIONAL FREQUENCY HZ *****	.046	.094	.145	.199	.256	.316
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	1039.5	1266.3	1506.2	1760.3	2029.2	2313.5
ARRAY WEIGHT (LB)	2286.9	2785.9	3313.7	3872.6	4464.2	5089.8
CENTER OF GRAVITY (IN)	1539.1	1499.3	1470.4	1448.1	1430.3	1415.7
BLANKET TENSION (LB)	10.84	43.37	97.59	173.49	271.08	390.35
MOMENT OF INERTIA I1	.8450+10	.9992+10	.1163+11	.1336+11	.1519+11	.1713+11
MOMENT OF INERTIA I2	.1503+08	.1510+08	.1520+08	.1535+08	.1555+08	.1578+08
SPECIFIC POWER (KW/KG)	.067	.055	.046	.040	.034	.030
SPECIFIC WEIGHT (KG/KW)	14.8	18.1	21.5	25.1	29.0	33.1
* BOOM PROPERTIES *						
DIAMETER (IN)	24.58	35.28	43.87	51.42	58.36	64.89
EI (LB-IN-SQ)	.17070+09	.72528+09	.17332+10	.32720+10	.54279+10	.82961+10
ROOT SPRING (LB-IN/RAD)	.1089+07	.3222+07	.6192+07	.9973+07	.1458+08	.2004+08
BUCKLING CAPABILITY RATIO	10.06	10.37	10.63	10.76	10.69	10.41
STRENGTH CAPABILITY RATIO	1.41	3.52	5.79	8.11	10.41	12.68
* CANNISTER PROPERTIES *						
HEIGHT (IN)	116.95	134.62	148.78	161.24	172.69	183.46
DIAMETER (IN)	29.00	41.63	51.76	60.68	68.86	76.57
* WEIGHTS (LB) *						
ARRAY	2286.9	2785.9	3313.7	3872.6	4464.2	5089.8
BOOM	361.3	744.7	1151.3	1581.8	2037.3	2518.8
CANNISTER	121.6	234.6	351.6	473.9	602.2	736.9
FULL TENSIONER	1.7	4.1	8.2	13.9	21.2	30.1
INTERMEDIATE TENSIONER	1.0	1.1	1.4	1.7	2.2	2.7

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1456.0	SUPPORT STRUCTURE =	8.2	INTERCONNECT HARNESS =	72.4
BOX COVER =	66.3	BOX HINGE =	1.4	COVER LATCH =	57.9
CONTAINER =	115.4	MAST TIP FITTING =	4.1	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	8.1
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	8.3		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 70.0 KW   ARRAY WIDTH = 8.50 M

ARRAY LENGTH = 83.02 M   ASPECT RATIO = 9.77   BLANKET AREA = .10938+07 IN=SQ   BLANKET WEIGHT = 1456.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.040	.083	.127	.174	.223	.274
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.045	.053
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	1009.6	1205.0	1409.9	1625.3	1851.7	2089.5
ARRAY WEIGHT (LB)	2221.2	2650.9	3101.8	3575.7	4073.8	4597.0
CENTER OF GRAVITY (IN)	1453.3	1415.6	1387.3	1365.0	1346.9	1331.7
BLANKET TENSION (LB)	10.21	40.82	91.85	163.28	255.13	367.39
MOMENT OF INERTIA I1	.7300+10	.8459+10	.9679+10	.1096+11	.1231+11	.1372+11
MOMENT OF INERTIA I2	.1693+08	.1700+08	.1711+08	.1727+08	.1748+08	.1773+08
SPECIFIC POWER (KW/KG)	.069	.058	.050	.043	.038	.034
SPECIFIC WEIGHT (KG/KW)	14.4	17.2	20.1	23.2	26.5	29.9
* BOOM PROPERTIES *						
DIAMETER (IN)	23.43	33.57	41.65	48.72	55.18	61.23
EI (LB-IN-SQ)	.14111+09	.59450+09	.14087+10	.26373+10	.43389+10	.65775+10
ROOT SPRING (LB-IN/RAD)	.9438+06	.2776+07	.5301+07	.8484+07	.1232+08	.1684+08
BUCKLING CAPABILITY RATIO	9.94	10.14	10.28	10.29	10.12	9.78
STRENGTH CAPABILITY RATIO	1.33	3.37	5.62	7.92	10.24	12.54
* CANNISTER PROPERTIES *						
HEIGHT (IN)	110.57	127.30	140.63	152.30	162.95	172.93
DIAMETER (IN)	27.65	39.61	49.15	57.49	65.11	72.25
* WEIGHTS (LB) *						
ARRAY	2221.2	2650.9	3101.8	3575.7	4073.8	4597.0
BOOM	309.2	634.6	976.9	1336.6	1714.4	2110.8
CANNISTER	110.2	212.1	316.6	425.1	538.1	656.0
FULL TENSIONER	1.6	3.9	7.7	13.1	20.0	28.4
INTERMEDIATE TENSIONER	1.0	1.1	1.4	1.7	2.1	2.6

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1456.0	SUPPORT STRUCTURE =	8.2	INTERCONNECT HARNESS =	72.4
BOX COVER =	66.3	BOX HINGE =	1.7	COVER LATCH =	54.7
CONTAINER =	116.6	MAST TIP FITTING =	4.1	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	8.1
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	7.9		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 70.0 KW   ARRAY WIDTH = 9.00 M

ARRAY LENGTH = 78.41 M   ASPECT RATIO = 8.71   BLANKET AREA = .10938+07 IN=SQ   BLANKET WEIGHT = 1456.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.036	.074	.113	.154	.196	.241
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.045	.053
*** ARRAY PROPERTIES ***						
ARRAY MASS (KG)	985.3	1155.3	1332.5	1517.7	1711.1	1913.2
ARRAY WEIGHT (LB)	2167.7	2541.6	2931.5	3338.9	3764.5	4209.1
CENTER OF GRAVITY (IN)	1376.7	1341.2	1313.9	1291.9	1273.6	1258.2
BLANKET TENSION (LB)	9.64	38.55	86.74	154.21	240.96	346.98
MOMENT OF INERTIA I1	.6377+10	.7265+10	.8192+10	.9161+10	.1017+11	.1123+11
MOMENT OF INERTIA I2	.1894+08	.1902+08	.1914+08	.1930+08	.1952+08	.1979+08
SPECIFIC POWER (KW/KG)	.071	.061	.053	.046	.041	.037
SPECIFIC WEIGHT (KG/KW)	14.1	16.5	19.0	21.7	24.4	27.3
*** BOOM PROPERTIES ***						
DIAMETER (IN)	22.41	32.05	39.70	46.36	52.41	58.06
EI (LB-IN=SQ)	.11806+09	.49395+09	.11625+10	.21614+10	.35319+10	.53182+10
ROOT SPRING (LB=IN/RAD)	.8257+06	.2415+07	.4589+07	.7308+07	.1056+08	.1436+08
BUCKLING CAPABILITY RATIO	9.84	9.95	9.99	9.90	9.66	9.26
STRENGTH CAPABILITY RATIO	1.26	3.23	5.43	7.72	10.04	12.36
*** CANNISTER PROPERTIES ***						
HEIGHT (IN)	104.89	120.80	133.41	144.40	154.39	163.71
DIAMETER (IN)	26.44	37.82	46.85	54.70	61.85	68.51
*** WEIGHTS (LB) ***						
ARRAY	2167.7	2541.6	2931.5	3338.9	3764.5	4209.1
BOOM	267.1	546.3	838.1	1142.8	1460.8	1792.6
CANNISTER	100.6	193.0	287.3	384.5	485.2	589.6
FULL TENSIONER	1.6	3.8	7.4	12.4	18.9	26.9
INTERMEDIATE TENSIONER	1.0	1.1	1.3	1.6	2.0	2.5

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1456.0	SUPPORT STRUCTURE =	8.2	INTERCONNECT HARNESS =	72.4
BOX COVER =	66.3	BOX HINGE =	2.0	COVER LATCH =	52.0
CONTAINER =	117.7	MAST TIP FITTING =	4.1	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	8.1
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	7.5		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 70.0 KW ARRAY WIDTH = 9.50 M

ARRAY LENGTH = 74.28 M ASPECT RATIO = 7.82 BLANKET AREA = .10938+07 IN=SQ BLANKET WEIGHT = 1456.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.032	.066	.101	.137	.174	.213
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.045	.053
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	965.2	1114.5	1269.4	1430.4	1597.8	1771.8
ARRAY WEIGHT (LB)	2123.5	2452.0	2792.7	3146.9	3515.1	3898.0
CENTER OF GRAVITY (IN)	1307.9	1274.7	1248.4	1226.9	1208.8	1193.3
BLANKET TENSION (LB)	9.13	36.52	82.18	146.10	228.28	328.72
MOMENT OF INERTIA I1	.5626+10	.6316+10	.7033+10	.7778+10	.8552+10	.9355+10
MOMENT OF INERTIA I2	.2107+08	.2115+08	.2127+08	.2145+08	.2168+08	.2196+08
SPECIFIC POWER (KW/KG)	.073	.063	.055	.049	.044	.040
SPECIFIC WEIGHT (KG/KW)	13.8	15.9	18.1	20.4	22.8	25.3
* BOOM PROPERTIES *						
DIAMETER (IN)	21.49	30.69	37.96	44.26	49.98	55.28
EI (LB-IN-SQ)	.99811+08	.41525+09	.97172+09	.17966+10	.29193+10	.43713+10
ROOT SPRING (LB-IN/RAD)	.7280+06	.2121+07	.4012+07	.6362+07	.9156+07	.1239+08
BUCKLING CAPABILITY RATIO	9.75	9.78	9.74	9.57	9.26	8.82
STRENGTH CAPABILITY RATIO	1.19	3.09	5.25	7.51	9.82	12.15
* CANNISTER PROPERTIES *						
HEIGHT (IN)	99.79	114.98	126.97	137.37	146.80	155.55
DIAMETER (IN)	25.36	36.22	44.79	52.23	58.97	65.23
* WEIGHTS (LB) *						
ARRAY	2123.5	2452.0	2792.7	3146.9	3515.1	3898.0
BOOM	232.7	474.5	725.9	987.1	1258.2	1539.6
CANNISTER	92.2	176.6	262.3	350.3	440.9	534.3
FULL TENSIONER	1.5	3.6	7.0	11.8	18.0	25.5
INTERMEDIATE TENSIONER	1.0	1.1	1.3	1.6	2.0	2.4

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1456.0	SUPPORT STRUCTURE =	8.2	INTERCONNECT HARNESS =	72.4
BOX COVER =	66.3	BOX HINGE =	2.3	COVER LATCH =	49.5
CONTAINER =	118.8	MAST TIP FITTING =	4.1	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	8.1
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	7.2		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 70.0 KW ARRAY WIDTH =10.00 M

ARRAY LENGTH = 70.56 M ASPECT RATIO = 7.06 BLANKET AREA = .10938+07 IN=SQ BLANKET WEIGHT = 1456.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.037	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.029	.060	.091	.123	.156	.191
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.037	.045	.053
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	948.5	1080.7	1217.3	1358.6	1505.0	1656.7
ARRAY WEIGHT (LB)	2086.7	2377.6	2678.0	2989.0	3311.1	3644.6
CENTER OF GRAVITY (IN)	1245.6	1214.6	1189.6	1168.7	1150.9	1135.5
BLANKET TENSION (LB)	8.67	34.70	78.07	138.79	216.86	312.28
MOMENT OF INERTIA I1	.5004+10	.5548+10	.6111+10	.6693+10	.7295+10	.7917+10
MOMENT OF INERTIA I2	.2331+08	.2339+08	.2353+08	.2371+08	.2395+08	.2425+08
SPECIFIC POWER (KW/KG)	.074	.065	.058	.052	.047	.042
SPECIFIC WEIGHT (KG/KW)	13.6	15.4	17.4	19.4	21.5	23.7
* BOOM PROPERTIES *						
DIAMETER (IN)	20.65	29.46	36.40	42.39	47.81	52.82
EI (LB=IN=SQ)	.85172+08	.35267+09	.82140+09	.15116+10	.24447+10	.36436+10
ROOT SPRING (LB=IN/RAD)	.6463+06	.1876+07	.3537+07	.5589+07	.8015+07	.1081+08
BUCKLING CAPABILITY RATIO	9.67	9.63	9.52	9.29	8.92	8.45
STRENGTH CAPABILITY RATIO	1.13	2.96	5.06	7.29	9.59	11.91
* CANNISTER PROPERTIES *						
HEIGHT (IN)	95.20	109.73	121.18	131.07	140.00	148.28
DIAMETER (IN)	24.37	34.77	42.95	50.02	56.41	62.33
* WEIGHTS (LB) *						
ARRAY	2086.7	2377.6	2678.0	2989.0	3311.1	3644.6
BOOM	204.2	415.5	634.0	860.1	1093.8	1335.4
CANNISTER	85.0	162.5	240.9	321.0	403.2	487.6
FULL TENSIONER	1.5	3.5	6.7	11.3	17.1	24.3
INTERMEDIATE TENSIONER	1.0	1.1	1.3	1.6	1.9	2.4

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1456.0	SUPPORT STRUCTURE =	8.2	INTERCONNECT HARNESS =	72.4
BOX COVER =	66.3	BOX HINGE =	2.6	COVER LATCH =	47.3
CONTAINER =	120.0	MAST TIP FITTING =	4.1	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	8.1
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	6.9		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 75.0 KW ARRAY WIDTH = 7.00 M

ARRAY LENGTH =108.01 M ASPECT RATIO = 15.43 BLANKET AREA = .11719+07 IN=SQ BLANKET WEIGHT = 1560.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.027	.036	.044	.051
***** TORSIONAL FREQUENCY HZ *****	.064	.135	.213	.297	.390	.490
***** BENDING FREQUENCY HZ *****	.010	.019	.027	.036	.044	.051
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	1251.5	1644.8	2074.6	2544.0	3055.4	3611.1
ARRAY WEIGHT (LB)	2753.2	3618.5	4564.2	5596.9	6722.0	7944.4
CENTER OF GRAVITY (IN)	1864.8	1822.6	1795.3	1775.8	1761.2	1749.8
BLANKET TENSION (LB)	14.23	56.90	128.03	227.61	355.64	512.12
MOMENT OF INERTIA I1	.1505+11	.1923+11	.2382+11	.2884+11	.3431+11	.4025+11
MOMENT OF INERTIA I2	.1246+08	.1252+08	.1263+08	.1278+08	.1297+08	.1321+08
SPECIFIC POWER (KW/KG)	.060	.046	.036	.029	.025	.021
SPECIFIC WEIGHT (KG/KW)	16.7	21.9	27.7	33.9	40.7	48.1
* BOOM PROPERTIES *						
DIAMETER (IN)	29.37	42.55	53.38	63.13	72.27	81.04
EI (LB=IN=SQ)	.34819+09	.15340+10	.37997+10	.74318+10	.12764+11	.20184+11
ROOT SPRING (LB=IN/RAD)	.1858+07	.5651+07	.1116+08	.1845+08	.2768+08	.3904+08
BUCKLING CAPABILITY RATIO	10.52	11.31	12.08	12.71	13.05	13.01
STRENGTH CAPABILITY RATIO	1.65	3.91	6.21	8.46	10.66	12.80
* CANNISTER PROPERTIES *						
HEIGHT (IN)	142.01	163.76	181.63	197.71	212.79	227.26
DIAMETER (IN)	34.66	50.21	62.99	74.49	85.27	95.62
* WEIGHTS (LB) *						
ARRAY	2753.2	3618.5	4564.2	5596.9	6722.0	7944.4
BOOM	631.9	1326.2	2087.3	2919.1	3825.6	4810.7
CANNISTER	174.5	342.0	521.0	714.0	922.4	1147.3
FULL TENSIONER	1.9	5.1	10.5	17.9	27.5	39.2
INTERMEDIATE TENSIONER	1.0	1.2	1.5	2.0	2.6	3.3

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1560.0	SUPPORT STRUCTURE =	8.6	INTERCONNECT HARNESS =	77.5
BOX COVER =	71.0	BOX HINGE =	.9	COVER LATCH =	79.6
CONTAINER =	120.1	MAST TIP FITTING =	4.2	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	8.7
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	9.9		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 75.0 KW   ARRAY WIDTH = 7.50 M

ARRAY LENGTH =100.81 M   ASPECT RATIO = 13.44   BLANKET AREA = .11719+07 IN-SQ   BLANKET WEIGHT = 1560.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
***** TORSIONAL FREQUENCY HZ *****	.056	.116	.182	.252	.328	.409
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	1193.7	1521.9	1875.9	2257.5	2668.4	3110.0
ARRAY WEIGHT (LB)	2626.0	3348.2	4126.9	4966.5	5870.5	6842.0
CENTER OF GRAVITY (IN)	1746.6	1704.7	1676.3	1655.5	1639.5	1626.7
BLANKET TENSION (LB)	13.28	53.11	119.50	212.44	331.93	477.98
MOMENT OF INERTIA I1	.1256+11	.1556+11	.1881+11	.2231+11	.2608+11	.3014+11
MOMENT OF INERTIA I2	.1425+08	.1432+08	.1443+08	.1459+08	.1480+08	.1505+08
SPECIFIC POWER (KW/KG)	.063	.049	.040	.033	.028	.024
SPECIFIC WEIGHT (KG/KW)	15.9	20.3	25.0	30.1	35.6	41.5
* BOOM PROPERTIES *						
DIAMETER (IN)	27.78	40.10	50.11	59.04	67.35	75.26
EI (LB-IN-SQ)	.27879+09	.12097+10	.29516+10	.56881+10	.96294+10	.15014+11
ROOT SPRING (LB-IN/RAD)	.1573+07	.4729+07	.9231+07	.1510+08	.2241+08	.3127+08
BUCKLING CAPABILITY RATIO	10.33	10.92	11.46	11.86	12.01	11.84
STRENGTH CAPABILITY RATIO	1.56	3.78	6.08	8.37	10.61	12.81
* CANNISTER PROPERTIES *						
HEIGHT (IN)	133.15	153.47	170.00	184.74	198.44	211.49
DIAMETER (IN)	32.78	47.31	59.13	69.67	79.47	88.81
* WEIGHTS (LB) *						
ARRAY	2626.0	3348.2	4126.9	4966.5	5870.5	6842.0
BOOM	527.7	1099.2	1717.0	2383.6	3101.3	3872.5
CANNISTER	155.7	303.3	458.9	624.5	801.2	990.0
FULL TENSIONER	1.9	4.8	9.8	16.8	25.7	36.7
INTERMEDIATE TENSIONER	1.0	1.2	1.5	1.9	2.4	3.1

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1560.0	SUPPORT STRUCTURE =	8.6	INTERCONNECT HARNESS =	77.5
BOX COVER =	71.0	BOX HINGE =	1.2	COVER LATCH =	74.6
CONTAINER =	121.2	MAST TIP FITTING =	4.2	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	8.7
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	9.3		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 75.0 KW   ARRAY WIDTH = 8.00 M

ARRAY LENGTH = 94.51 M   ASPECT RATIO = 11.81   BLANKET AREA = .11719+07 IN-SQ   BLANKET WEIGHT = 1560.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
***** TORSIONAL FREQUENCY HZ *****	.049	.101	.157	.217	.280	.348
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	1148.0	1426.3	1723.0	2039.7	2377.4	2737.1
ARRAY WEIGHT (LB)	2525.6	3137.8	3790.6	4487.4	5230.3	6021.6
CENTER OF GRAVITY (IN)	1643.0	1602.3	1573.6	1551.9	1534.9	1521.0
BLANKET TENSION (LB)	12.45	49.79	112.03	199.16	311.19	448.11
MOMENT OF INERTIA I1	.1066+11	.1287+11	.1523+11	.1775+11	.2043+11	.2329+11
MOMENT OF INERTIA I2	.1616+08	.1623+08	.1635+08	.1653+08	.1675+08	.1702+08
SPECIFIC POWER (KW/KG)	.065	.053	.044	.037	.032	.027
SPECIFIC WEIGHT (KG/KW)	15.3	19.0	23.0	27.2	31.7	36.5
* BOOM PROPERTIES *						
DIAMETER (IN)	26.39	37.97	47.32	55.58	63.22	70.44
EI (LB-IN-SQ)	.22695+09	.97288+09	.23456+10	.44671+10	.74748+10	.11523+11
ROOT SPRING (LB-IN/RAD)	.1348+07	.4016+07	.7770+07	.1260+08	.1853+08	.2564+08
BUCKLING CAPABILITY RATIO	10.17	10.60	10.97	11.20	11.20	10.94
STRENGTH CAPABILITY RATIO	1.48	3.64	5.94	8.25	10.52	12.76
* CANNISTER PROPERTIES *						
HEIGHT (IN)	125.40	144.51	159.93	173.57	186.16	198.08
DIAMETER (IN)	31.14	44.81	55.83	65.59	74.60	83.12
* WEIGHTS (LB) *						
ARRAY	2525.6	3137.8	3790.6	4487.4	5230.3	6021.6
BOOM	446.3	924.1	1434.9	1980.3	2561.6	3180.4
CANNISTER	140.1	271.6	408.7	553.1	705.9	867.4
FULL TENSIONER	1.8	4.6	9.3	15.8	24.2	34.4
INTERMEDIATE TENSIONER	1.0	1.2	1.4	1.8	2.4	3.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1560.0	SUPPORT STRUCTURE =	8.6	INTERCONNECT HARNESS =	77.5
BOX COVER =	71.0	BOX HINGE =	1.5	COVER LATCH =	70.3
CONTAINER =	122.4	MAST TIP FITTING =	4.2	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	8.7
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	8.8		

ARRAY TYPE LMSC FOLDOUT | POWER/WING = 75.0 KW | ARRAY WIDTH = 8.50 M

ARRAY LENGTH = 88.95 M | ASPECT RATIO = 10.46 | BLANKET AREA = .11719+07 IN-SQ | BLANKET WEIGHT = 1560.0 LB

FREQUENCY DEPENDENT PARAMETERS

/***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
***** TORSIONAL FREQUENCY HZ *****	.043	.089	.138	.189	.243	.300
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	1111.3	1350.3	1602.9	1870.2	2153.0	2451.9
ARRAY WEIGHT (LB)	2444.9	2970.6	3526.3	4114.4	4736.5	5394.1
CENTER OF GRAVITY (IN)	1551.4	1512.3	1483.8	1461.7	1444.0	1429.4
BLANKET TENSION (LB)	11.72	46.86	105.44	187.44	292.88	421.75
MOMENT OF INERTIA I1	.9183+10	.1084+11	.1259+11	.1445+11	.1641+11	.1849+11
MOMENT OF INERTIA I2	.1819+08	.1827+08	.1840+08	.1858+08	.1882+08	.1911+08
SPECIFIC POWER (KW/KG)	.067	.056	.047	.040	.035	.031
SPECIFIC WEIGHT (KG/KW)	14.8	18.0	21.4	24.9	28.7	32.7
* BOOM PROPERTIES *						
DIAMETER (IN)	25.15	36.11	44.88	52.60	59.68	66.35
EI (LB-IN-SQ)	.18737+09	.79546+09	.18994+10	.35829+10	.59389+10	.90701+10
ROOT SPRING (LB-IN/RAD)	.1167+07	.3453+07	.6633+07	.1068+08	.1560+08	.2143+08
BUCKLING CAPABILITY RATIO	10.04	10.34	10.58	10.67	10.56	10.23
STRENGTH CAPABILITY RATIO	1.40	3.50	5.78	8.09	10.39	12.67
* CANNISTER PROPERTIES *						
HEIGHT (IN)	118.55	136.62	151.10	163.83	175.52	186.52
DIAMETER (IN)	29.68	42.61	52.96	62.07	70.43	78.29
* WEIGHTS (LB) *						
ARRAY	2444.9	2970.6	3526.3	4114.4	4736.5	5394.1
BOOM	381.7	786.5	1215.3	1669.2	2149.0	2655.8
CANNISTER	127.0	245.2	367.4	495.1	629.0	769.5
FULL TENSIONER	1.7	4.4	8.8	14.9	22.8	32.5
INTERMEDIATE TENSIONER	1.0	1.1	1.4	1.8	2.3	2.9

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1560.0	SUPPORT STRUCTURE =	8.6	INTERCONNECT HARNESS =	77.5
BOX COVER =	71.0	BOX HINGE =	1.8	COVER LATCH =	66.4
CONTAINER =	123.5	MAST TIP FITTING =	4.2	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	8.7
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	8.4		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 75.0 KW   ARRAY WIDTH = 9.00 M

ARRAY LENGTH = 84.01 M   ASPECT RATIO = 9.33   BLANKET AREA = .11719+07 IN-SQ   BLANKET WEIGHT = 1560.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.039	.079	.122	.166	.213	.262
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.045	.053
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	1081.4	1288.9	1506.7	1735.6	1976.1	2228.6
ARRAY WEIGHT (LB)	2379.2	2835.7	3314.8	3818.2	4347.3	4903.0
CENTER OF GRAVITY (IN)	1469.7	1432.5	1404.6	1382.5	1364.5	1349.4
BLANKET TENSION (LB)	11.06	44.26	99.58	177.03	276.61	398.32
MOMENT OF INERTIA I1	.8000+10	.9266+10	.1060+11	.1199+11	.1346+11	.1500+11
MOMENT OF INERTIA I2	.2035+08	.2043+08	.2057+08	.2076+08	.2101+08	.2132+08
SPECIFIC POWER (KW/KG)	.069	.058	.050	.043	.038	.034
SPECIFIC WEIGHT (KG/KW)	14.4	17.2	20.1	23.1	26.3	29.7
* BOOM PROPERTIES *						
DIAMETER (IN)	24.05	34.46	42.75	50.00	56.62	62.82
EI (LB-IN-SQ)	.15660+09	.65958+09	.15626+10	.29246+10	.48103+10	.72903+10
ROOT SPRING (LB-IN/RAD)	.1021+07	.3000+07	.5729+07	.9168+07	.1332+08	.1819+08
BUCKLING CAPABILITY RATIO	9.93	10.13	10.25	10.23	10.03	9.64
STRENGTH CAPABILITY RATIO	1.33	3.37	5.61	7.92	10.23	12.53
* CANNISTER PROPERTIES *						
HEIGHT (IN)	112.44	129.61	143.29	155.26	166.19	176.42
DIAMETER (IN)	28.38	40.66	50.44	59.00	66.81	74.13
* WEIGHTS (LB) *						
ARRAY	2379.2	2835.7	3314.8	3818.2	4347.3	4903.0
BOOM	329.6	676.4	1041.1	1424.3	1826.6	2248.7
CANNISTER	115.8	222.9	332.9	447.0	565.8	689.7
FULL TENSIONER	1.7	4.2	8.3	14.1	21.6	30.7
INTERMEDIATE TENSIONER	1.0	1.1	1.4	1.7	2.2	2.8

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1560.0	SUPPORT STRUCTURE =	8.6	INTERCONNECT HARNESS =	77.5
BOX COVER =	71.0	BOX HINGE =	2.1	COVER LATCH =	63.0
CONTAINER =	124.7	MAST TIP FITTING =	4.2	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	8.7
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	8.0		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 75.0 KW   ARRAY WIDTH = 9.50 M

ARRAY LENGTH = 79.58 M   ASPECT RATIO = 8.38   BLANKET AREA = .11719+07 IN-SQ   BLANKET WEIGHT = 1560.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.035	.071	.109	.148	.189	.232
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.045	.053
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	1056.8	1238.7	1428.5	1626.8	1834.0	2050.6
ARRAY WEIGHT (LB)	2324.9	2725.2	3142.7	3578.9	4034.9	4511.2
CENTER OF GRAVITY (IN)	1396.3	1361.2	1334.1	1312.3	1294.1	1278.7
BLANKET TENSION (LB)	10.48	41.93	94.34	167.71	262.05	377.35
MOMENT OF INERTIA I1	.7041+10	.8024+10	.9051+10	.1012+11	.1124+11	.1241+11
MOMENT OF INERTIA I2	.2263+08	.2272+08	.2286+08	.2307+08	.2333+08	.2365+08
SPECIFIC POWER (KW/KG)	.071	.061	.053	.046	.041	.037
SPECIFIC WEIGHT (KG/KW)	14.1	16.5	19.0	21.7	24.5	27.3
* BOOM PROPERTIES *						
DIAMETER (IN)	23.06	32.98	40.85	47.70	53.93	59.75
EI (LB-IN-SQ)	.13228+09	.55355+09	.13029+10	.24228+10	.39595+10	.59629+10
ROOT SPRING (LB-IN/RAD)	.8992+06	.2631+07	.4999+07	.7961+07	.1151+08	.1564+08
BUCKLING CAPABILITY RATIO	9.83	9.94	9.97	9.87	9.59	9.16
STRENGTH CAPABILITY RATIO	1.26	3.23	5.44	7.73	10.05	12.36
* CANNISTER PROPERTIES *						
HEIGHT (IN)	106.98	123.35	136.33	147.64	157.92	167.51
DIAMETER (IN)	27.21	38.91	48.20	56.29	63.64	70.50
* WEIGHTS (LB) *						
ARRAY	2324.9	2725.2	3142.7	3578.9	4034.9	4511.2
BOOM	287.0	587.0	900.6	1228.1	1570.0	1926.7
CANNISTER	106.2	203.9	303.6	406.5	513.1	623.6
FULL TENSIONER	1.6	4.0	7.9	13.4	20.5	29.1
INTERMEDIATE TENSIONER	1.0	1.1	1.4	1.7	2.1	2.7

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1560.0	SUPPORT STRUCTURE =	8.6	INTERCONNECT HARNESS =	77.5
BOX COVER =	71.0	BOX HINGE =	2.4	COVER LATCH =	59.9
CONTAINER =	125.8	MAST TIP FITTING =	4.2	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	8.7
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	7.6		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 75.0 KW   ARRAY WIDTH =10.00 M

ARRAY LENGTH = 75.60 M   ASPECT RATIO = 7.56   BLANKET AREA = .11719+07 IN=SQ   BLANKET WEIGHT = 1560.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.031	.064	.098	.133	.169	.207
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.045	.053
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	1036.2	1197.1	1364.0	1537.6	1718.2	1906.1
ARRAY WEIGHT (LB)	2279.7	2633.6	3000.8	3382.8	3780.1	4193.4
CENTER OF GRAVITY (IN)	1330.0	1297.0	1270.9	1249.5	1231.4	1215.9
BLANKET TENSION (LB)	9.96	39.83	89.62	159.33	248.95	358.49
MOMENT OF INERTIA I1	.6251+10	.7024+10	.7829+10	.8665+10	.9534+10	.1044+11
MOMENT OF INERTIA I2	.2503+08	.2512+08	.2528+08	.2549+08	.2577+08	.2611+08
SPECIFIC POWER (KW/KG)	.072	.063	.055	.049	.044	.039
SPECIFIC WEIGHT (KG/KW)	13.8	16.0	18.2	20.5	22.9	25.4
* BOOM PROPERTIES *						
DIAMETER (IN)	22.16	31.65	39.15	45.65	51.55	57.03
EI (LB=IN=SQ)	.11280+09	.46948+09	.10990+10	.20328+10	.33044+10	.49498+10
ROOT SPRING (LB=IN/RAD)	.7979+06	.2325+07	.4400+07	.6979+07	.1005+08	.1360+08
BUCKLING CAPABILITY RATIO	9.75	9.78	9.73	9.55	9.21	8.75
STRENGTH CAPABILITY RATIO	1.20	3.10	5.26	7.53	9.84	12.16
* CANNISTER PROPERTIES *						
HEIGHT (IN)	102.04	117.70	130.08	140.81	150.54	159.58
DIAMETER (IN)	26.15	37.34	46.19	53.87	60.83	67.29
* WEIGHTS (LB) *						
ARRAY	2279.7	2633.6	3000.8	3382.8	3780.1	4193.4
BOOM	251.7	513.6	785.8	1068.7	1362.5	1667.6
CANNISTER	97.8	187.5	278.5	372.1	468.4	567.9
FULL TENSIONER	1.6	3.8	7.6	12.8	19.5	27.7
INTERMEDIATE TENSIONER	1.0	1.1	1.3	1.7	2.1	2.6

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1560.0	SUPPORT STRUCTURE =	8.6	INTERCONNECT HARNESS =	77.5
BOX COVER =	71.0	BOX HINGE =	2.8	COVER LATCH =	57.2
CONTAINER =	126.9	MAST TIP FITTING =	4.2	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	8.7
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	7.3		

ARRAY TYPE LMSC FOLDOUT POWER/WING = 80.0 KW ARRAY WIDTH = 7.00 M

ARRAY LENGTH =115.21 M ASPECT RATIO = 16.46 BLANKET AREA = .12500+07 IN-SQ BLANKET WEIGHT = 1664.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.027	.035	.043	.051
***** TORSIONAL FREQUENCY HZ *****	.069	.146	.231	.325	.429	.542
***** BENDING FREQUENCY HZ *****	.010	.019	.027	.035	.043	.051
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	1389.8	1870.2	2401.6	2988.2	3633.6	4341.1
ARRAY WEIGHT (LB)	3057.5	4114.5	5283.6	6574.0	7993.9	9550.3
CENTER OF GRAVITY (IN)	1982.7	1942.1	1916.8	1899.1	1886.1	1876.0
BLANKET TENSION (LB)	16.19	64.74	145.67	258.97	404.64	582.68
MOMENT OF INERTIA I1	.1893+11	.2482+11	.3136+11	.3858+11	.4654+11	.5526+11
MOMENT OF INERTIA I2	.1334+08	.1342+08	.1354+08	.1371+08	.1393+08	.1420+08
SPECIFIC POWER (KW/KG)	.058	.043	.033	.027	.022	.018
SPECIFIC WEIGHT (KG/KW)	17.4	23.4	30.0	37.4	45.4	54.3
* BOOM PROPERTIES *						
DIAMETER (IN)	31.43	45.69	57.50	68.22	78.34	88.11
EI (LB-IN-SQ)	.45675+09	.20390+10	.51169+10	.10136+11	.17625+11	.28202+11
ROOT SPRING (LB-IN/RAD)	.2278+07	.6995+07	.1395+08	.2329+08	.3526+08	.5017+08
BUCKLING CAPABILITY RATIO	10.68	11.65	12.61	13.42	13.89	13.88
STRENGTH CAPABILITY RATIO	1.71	3.99	6.28	8.50	10.66	12.76
* CANNISTER PROPERTIES *						
HEIGHT (IN)	151.65	175.17	194.67	212.35	229.04	245.16
DIAMETER (IN)	37.09	53.91	67.85	80.50	92.44	103.97
* WEIGHTS (LB) *						
ARRAY	3057.5	4114.5	5283.6	6574.0	7993.9	9550.3
BOOM	771.9	1631.0	2583.7	3636.4	4795.1	6065.6
CANNISTER	199.8	393.9	603.8	832.6	1082.1	1353.9
FULL TENSIONER	2.1	5.7	11.8	20.3	31.2	44.5
INTERMEDIATE TENSIONER	1.0	1.2	1.6	2.1	2.8	3.6

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1664.0	SUPPORT STRUCTURE =	9.1	INTERCONNECT HARNESS =	82.7
BOX COVER =	75.8	BOX HINGE =	1.0	COVER LATCH =	95.7
CONTAINER =	127.1	MAST TIP FITTING =	4.4	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	9.3
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	10.5		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 80.0 KW   ARRAY WIDTH = 7.50 M

ARRAY LENGTH =107.53 M   ASPECT RATIO = 14.34   BLANKET AREA = .12500+07 IN=SQ   BLANKET WEIGHT = 1664.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.027	.036	.044	.051
***** TORSIONAL FREQUENCY HZ *****	.060	.125	.197	.274	.359	.450
***** BENDING FREQUENCY HZ *****	.010	.019	.027	.036	.044	.051
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	1319.3	1718.9	2154.1	2627.9	3142.4	3699.9
ARRAY WEIGHT (LB)	2902.5	3781.6	4739.1	5781.3	6913.3	8139.7
CENTER OF GRAVITY (IN)	1856.6	1815.3	1788.3	1768.8	1754.1	1742.4
BLANKET TENSION (LB)	15.11	60.43	135.96	241.71	377.67	543.84
MOMENT OF INERTIA I1	.1573+11	.1994+11	.2454+11	.2955+11	.3500+11	.4090+11
MOMENT OF INERTIA I2	.1526+08	.1533+08	.1547+08	.1565+08	.1588+08	.1617+08
SPECIFIC POWER (KW/KG)	.061	.047	.037	.030	.025	.022
SPECIFIC WEIGHT (KG/KW)	16.5	21.5	26.9	32.8	39.3	46.2
* BOOM PROPERTIES *						
DIAMETER (IN)	29.72	43.01	53.90	63.68	72.83	81.59
EI (LB-IN-SQ)	.36494+09	.16012+10	.39503+10	.76959+10	.13167+11	.20744+11
ROOT SPRING (LB-IN/RAD)	.1925+07	.5835+07	.1149+08	.1894+08	.2834+08	.3985+08
BUCKLING CAPABILITY RATIO	10.47	11.20	11.89	12.43	12.68	12.54
STRENGTH CAPABILITY RATIO	1.63	3.87	6.18	8.44	10.65	12.81
* CANNISTER PROPERTIES *						
HEIGHT (IN)	142.17	164.10	182.07	198.21	213.30	227.76
DIAMETER (IN)	35.07	50.75	63.60	75.14	85.94	96.28
* WEIGHTS (LB) *						
ARRAY	2902.5	3781.6	4739.1	5781.3	6913.3	8139.7
BOOM	644.0	1349.0	2118.8	2957.3	3868.3	4855.3
CANNISTER	178.1	348.6	530.3	725.5	935.7	1162.0
FULL TENSIONER	2.0	5.4	11.1	19.0	29.2	41.6
INTERMEDIATE TENSIONER	1.0	1.2	1.6	2.0	2.7	3.4

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1664.0	SUPPORT STRUCTURE =	9.1	INTERCONNECT HARNESS =	82.7
BOX COVER =	75.8	BOX HINGE =	1.3	COVER LATCH =	89.7
CONTAINER =	128.2	MAST TIP FITTING =	4.4	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	9.3
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	9.9		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 80.0 KW   ARRAY WIDTH = 8.00 M

ARRAY LENGTH =100.81 M   ASPECT RATIO = 12.60   BLANKET AREA = .12500+07 IN=SQ   BLANKET WEIGHT = 1664.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
***** TORSIONAL FREQUENCY HZ *****	.092	.109	.170	.235	.305	.381
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	1263.8	1601.5	1964.8	2355.7	2775.8	3226.5
ARRAY WEIGHT (LB)	2780.4	3523.3	4322.6	5182.6	6106.8	7098.2
CENTER OF GRAVITY (IN)	1746.2	1705.4	1677.4	1656.7	1640.7	1627.8
BLANKET TENSION (LB)	14.16	56.65	127.46	226.60	354.06	509.85
MOMENT OF INERTIA I1	.1330+11	.1639+11	.1972+11	.2331+11	.2716+11	.3129+11
MOMENT OF INERTIA I2	.1730+08	.1738+08	.1752+08	.1772+08	.1797+08	.1828+08
SPECIFIC POWER (KW/KG)	.063	.050	.041	.034	.029	.025
SPECIFIC WEIGHT (KG/KW)	15.8	20.0	24.6	29.4	34.7	40.3
* BOOM PROPERTIES *						
DIAMETER (IN)	28.21	40.69	50.83	59.85	68.23	76.19
EI (LB=IN=SQ)	.29658+09	.12835+10	.31239+10	.60051+10	.10141+11	.15774+11
ROOT SPRING (LB=IN/RAD)	.1648+07	.4944+07	.9633+07	.1573+08	.2330+08	.3245+08
BUCKLING CAPABILITY RATIO	10.29	10.84	11.34	11.68	11.75	11.51
STRENGTH CAPABILITY RATIO	1.55	3.75	6.06	8.35	10.60	12.80
* CANNISTER PROPERTIES *						
HEIGHT (IN)	133.87	154.46	171.18	186.07	199.89	213.03
DIAMETER (IN)	33.29	48.02	59.98	70.62	80.51	89.91
* WEIGHTS (LB) *						
ARRAY	2780.4	3523.3	4322.6	5182.6	6106.8	7098.2
BOOM	544.3	1132.3	1766.4	2449.1	3182.6	3969.2
CANNISTER	160.1	311.7	471.2	640.7	821.2	1013.6
FULL TENSIONER	1.9	5.1	10.4	17.8	27.4	39.1
INTERMEDIATE TENSIONER	1.0	1.2	1.5	2.0	2.6	3.3

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1664.0	SUPPORT STRUCTURE =	9.1	INTERCONNECT HARNESS =	82.7
BOX COVER =	75.8	BOX HINGE =	1.6	COVER LATCH =	84.4
CONTAINER =	129.3	MAST TIP FITTING =	4.4	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	9.3
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	9.3		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 80.0 KW   ARRAY WIDTH = 8.50 M

ARRAY LENGTH = 94.88 M   ASPECT RATIO = 11.16   BLANKET AREA = .12500+07 IN=SQ   BLANKET WEIGHT = 1664.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
***** TORSIONAL FREQUENCY HZ *****	.046	.096	.148	.204	.264	.327
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	1219.3	1508.5	1816.6	2145.0	2494.8	2866.9
ARRAY WEIGHT (LB)	2682.4	3318.8	3996.6	4719.1	5488.6	6307.2
CENTER OF GRAVITY (IN)	1648.8	1609.0	1580.7	1559.3	1542.3	1528.4
BLANKET TENSION (LB)	13.33	53.32	119.96	213.27	333.23	479.86
MOMENT OF INERTIA I1	.1141+11	.1373+11	.1620+11	.1883+11	.2163+11	.2462+11
MOMENT OF INERTIA I2	.1947+08	.1956+08	.1971+08	.1992+08	.2018+08	.2051+08
SPECIFIC POWER (KW/KG)	.066	.053	.044	.037	.032	.028
SPECIFIC WEIGHT (KG/KW)	15.2	18.9	22.7	26.8	31.2	35.8
* BOOM PROPERTIES *						
DIAMETER (IN)	26.89	38.67	48.17	56.57	64.31	71.63
EI (LB=IN=SQ)	.24453+09	.10467+10	.25196+10	.47914+10	.80056+10	.12323+11
ROOT SPRING (LB=IN/RAD)	.1426+07	.4242+07	.8198+07	.1328+08	.1951+08	.2696+08
BUCKLING CAPABILITY RATIO	10.15	10.56	10.89	11.07	11.02	10.70
STRENGTH CAPABILITY RATIO	1.47	3.62	5.92	8.22	10.51	12.75
* CANNISTER PROPERTIES *						
HEIGHT (IN)	126.54	145.98	161.66	175.51	188.29	200.37
DIAMETER (IN)	31.73	45.63	56.84	66.75	75.89	84.53
* WEIGHTS (LB) *						
ARRAY	2682.4	3318.8	3996.6	4719.1	5488.6	6307.2
BOOM	465.1	962.3	1493.1	2058.9	2661.4	3301.9
CANNISTER	145.0	281.0	422.8	572.0	729.5	896.0
FULL TENSIONER	1.9	4.9	9.9	16.8	25.8	36.8
INTERMEDIATE TENSIONER	1.0	1.2	1.5	1.9	2.5	3.1

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1664.0	SUPPORT STRUCTURE =	9.1	INTERCONNECT HARNESS =	82.7
BOX COVER =	75.8	BOX HINGE =	1.9	COVER LATCH =	79.7
CONTAINER =	130.5	MAST TIP FITTING =	4.4	MID TENSION MECHANISM =	.04
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	9.3
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	8.8		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 80.0 KW   ARRAY WIDTH = 9.00 M

ARRAY LENGTH = 89.61 M   ASPECT RATIO = 9.96   BLANKET AREA = .12500+07 IN=SQ   BLANKET WEIGHT = 1664.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
***** TORSIONAL FREQUENCY HZ *****	.041	.085	.131	.180	.231	.285
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.044	.052
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	1183.0	1433.6	1698.4	1978.4	2274.5	2587.2
ARRAY WEIGHT (LB)	2602.6	3154.0	3736.5	4352.6	5003.9	5691.9
CENTER OF GRAVITY (IN)	1562.0	1523.7	1495.6	1473.8	1456.2	1441.6
BLANKET TENSION (LB)	12.59	50.36	113.30	201.42	314.72	453.20
MOMENT OF INERTIA I1	.9914+10	.1168+11	.1355+11	.1553+11	.1762+11	.1982+11
MOMENT OF INERTIA I2	.2177+08	.2187+08	.2202+08	.2224+08	.2253+08	.2287+08
SPECIFIC POWER (KW/KG)	.068	.056	.047	.040	.035	.031
SPECIFIC WEIGHT (KG/KW)	14.8	17.9	21.2	24.7	28.4	32.3
* BOOM PROPERTIES *						
DIAMETER (IN)	25.70	36.88	45.84	53.71	60.93	67.72
EI (LB-IN-SQ)	.20415+09	.86599+09	.20661+10	.38943+10	.64499+10	.98428+10
ROOT SPRING (LB-IN/RAD)	.1245+07	.3680+07	.7065+07	.1136+08	.1659+08	.2278+08
BUCKLING CAPABILITY RATIO	10.03	10.31	10.52	10.58	10.42	10.05
STRENGTH CAPABILITY RATIO	1.40	3.49	5.76	8.08	10.38	12.66
* CANNISTER PROPERTIES *						
HEIGHT (IN)	120.02	138.47	153.24	166.23	178.14	189.35
DIAMETER (IN)	30.33	43.52	54.09	63.38	71.90	79.91
* WEIGHTS (LB) *						
ARRAY	2602.6	3154.0	3736.5	4352.6	5003.9	5691.9
BOOM	401.4	826.7	1276.9	1753.1	2256.1	2787.1
CANNISTER	132.2	255.2	382.5	515.4	654.6	800.7
FULL TENSIONER	1.8	4.6	9.4	16.0	24.4	34.8
INTERMEDIATE TENSIONER	1.0	1.2	1.4	1.9	2.4	3.0

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1664.0	SUPPORT STRUCTURE =	9.1	INTERCONNECT HARNESS =	82.7
BOX COVER =	75.8	BOX HINGE =	2.2	COVER LATCH =	75.6
CONTAINER =	131.6	MAST TIP FITTING =	4.4	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	9.3
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	8.4		

ARRAY TYPE LMSC FOLDOUT   POWER/WING = 80.0 KW   ARRAY WIDTH = 9.50 M

ARRAY LENGTH = 84.89 M   ASPECT RATIO = 8.94   BLANKET AREA = .12500+07 IN-SQ   BLANKET WEIGHT = 1664.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.045	.052
***** TORSIONAL FREQUENCY HZ *****	.037	.076	.117	.159	.204	.251
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.045	.052
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	1153.1	1372.4	1602.6	1844.4	2098.4	2365.2
ARRAY WEIGHT (LB)	2536.9	3019.4	3525.6	4057.6	4616.5	5203.4
CENTER OF GRAVITY (IN)	1484.1	1447.5	1419.9	1398.1	1380.1	1365.1
BLANKET TENSION (LB)	11.93	47.71	107.34	190.82	298.16	429.35
MOMENT OF INERTIA I1	.8704+10	.1007+11	.1151+11	.1303+11	.1461+11	.1628+11
MOMENT OF INERTIA I2	.2421+08	.2431+08	.2447+08	.2470+08	.2500+08	.2537+08
SPECIFIC POWER (KW/KG)	.069	.058	.050	.043	.038	.034
SPECIFIC WEIGHT (KG/KW)	14.4	17.2	20.0	23.1	26.2	29.6
* BOOM PROPERTIES *						
DIAMETER (IN)	24.63	35.29	43.77	51.19	57.97	64.32
EI (LB-IN-SQ)	.17230+09	.72548+09	.17182+10	.32148+10	.52860+10	.80089+10
ROOT SPRING (LB-IN/RAD)	.1096+07	.3223+07	.6152+07	.9842+07	.1429+08	.1952+08
BUCKLING CAPABILITY RATIO	9.92	10.11	10.22	10.17	9.93	9.51
STRENGTH CAPABILITY RATIO	1.33	3.36	5.60	7.91	10.22	12.52
* CANNISTER PROPERTIES *						
HEIGHT (IN)	114.17	131.75	145.75	158.00	169.18	179.65
DIAMETER (IN)	29.07	41.64	51.65	60.41	68.41	75.89
* WEIGHTS (LB) *						
ARRAY	2536.9	3019.4	3525.6	4057.6	4616.5	5203.4
BOOM	349.3	716.8	1103.2	1509.0	1935.0	2381.7
CANNISTER	121.1	233.3	348.5	467.9	592.4	722.1
FULL TENSIONER	1.8	4.4	8.9	15.2	23.2	33.0
INTERMEDIATE TENSIONER	1.0	1.1	1.4	1.8	2.3	2.9

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1664.0	SUPPORT STRUCTURE =	9.1	INTERCONNECT HARNESS =	82.7
BOX COVER =	75.8	BOX HINGE =	2.6	COVER LATCH =	71.9
CONTAINER =	132.7	MAST TIP FITTING =	4.4	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	9.3
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	8.0		

ORIGINAL PAGE IS
OF POOR QUALITY

ARRAY TYPE LMSC FOLDOUT POWER/WING = 80.0 KW ARRAY WIDTH =10.00 M

ARRAY LENGTH = 80.65 M ASPECT RATIO = 8.06 BLANKET AREA = .12500+07 IN=SQ BLANKET WEIGHT = 1664.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.028	.036	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.033	.068	.105	.143	.182	.223
***** BENDING FREQUENCY HZ *****	.010	.019	.028	.036	.045	.053
* ARRAY PROPERTIES *						
ARRAY MASS (KG)	1128.2	1321.8	1523.7	1734.8	1955.4	2185.9
ARRAY WEIGHT (LB)	2482.1	2907.9	3352.2	3816.5	4301.9	4809.0
CENTER OF GRAVITY (IN)	1413.7	1379.0	1352.2	1330.5	1312.5	1297.2
BLANKET TENSION (LB)	11.33	45.32	101.97	181.28	283.25	407.88
MOMENT OF INERTIA I1	.7711+10	.8788+10	.9914+10	.1109+11	.1232+11	.1360+11
MOMENT OF INERTIA I2	.2677+08	.2687+08	.2705+08	.2729+08	.2761+08	.2799+08
SPECIFIC POWER (KW/KG)	.071	.061	.053	.046	.041	.037
SPECIFIC WEIGHT (KG/KW)	14.1	16.5	19.0	21.7	24.4	27.3
* BOOM PROPERTIES *						
DIAMETER (IN)	23.67	33.85	41.93	48.96	55.36	61.33
EI (LB=IN=SQ)	.14681+09	.61438+09	.14461+10	.26893+10	.43951+10	.66192+10
ROOT SPRING (LB=IN/RAD)	.9723+06	.2845+07	.5406+07	.8609+07	.1244+08	.1692+08
BUCKLING CAPABILITY RATIO	9.83	9.93	9.95	9.83	9.52	9.06
STRENGTH CAPABILITY RATIO	1.26	3.23	5.44	7.73	10.05	12.36
* CANNISTER PROPERTIES *						
HEIGHT (IN)	108.90	125.70	139.03	150.64	161.19	171.04
DIAMETER (IN)	27.93	39.94	49.47	57.77	65.32	72.36
* WEIGHTS (LB) *						
ARRAY	2482.1	2907.9	3352.2	3816.5	4301.9	4809.0
BOOM	306.3	626.7	961.5	1311.1	1676.2	2057.0
CANNISTER	111.6	214.4	319.4	427.7	539.9	656.2
FULL TENSIONER	1.7	4.3	8.5	14.4	22.1	31.4
INTERMEDIATE TENSIONER	1.0	1.1	1.4	1.8	2.2	2.8

FREQUENCY INDEPENDENT WEIGHTS (LB)

BLANKET =	1664.0	SUPPORT STRUCTURE =	9.1	INTERCONNECT HARNESS =	82.7
BOX COVER =	75.8	BOX HINGE =	2.9	COVER LATCH =	68.5
CONTAINER =	133.9	MAST TIP FITTING =	4.4	MID TENSION MECHANISM =	.05
CONT BX CRUISE LATCH =	2.8	CONT BX CVR CR LATCH =	.4	CONT BX DEPLOY DEVICE =	9.3
CONT BX LAUNCH LATCH =	.1	GUIDE WIRE TENSIONER =	7.7		

@FIN NIF@

II

DETAILED COMPUTER OUTPUT

FOR

ROLLOUT ARRAY

ARRAY TYPE GE ROLLOUT POWER/WING = 8.0 KW ARRAY WIDTH = 3.00 M

BLANKET AREA = .88889+05 IN-SQ BLANKET WEIGHT = 48.8 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.022	.037	.052	.062	.071	.079
***** TORSIONAL FREQUENCY HZ *****	.022	.037	.052	.062	.071	.079
***** BENDING FREQUENCY HZ *****	.044	.076	.107	.131	.150	.168
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	44.0	43.4	42.9	42.6	42.3	42.1
ARRAY LENGTH (M)	25.64	26.01	26.32	26.53	26.69	26.83
ASPECT RATIO	8.55	8.67	8.77	8.84	8.90	8.94
ARRAY MASS (KG)	38.6	40.7	43.0	44.9	46.4	47.8
ARRAY WEIGHT (LB)	84.8	89.6	94.6	98.7	102.1	105.2
CENTER OF GRAVITY (IN)	358.4	357.0	353.9	351.0	349.1	347.2
TENSION PER BLANKET (LB)	.50	1.50	3.00	4.50	6.00	7.50
MOMENT OF INERTIA I1	.2170+08	.2315+08	.2448+08	.2552+08	.2641+08	.2719+08
MOMENT OF INERTIA I2	.5139+05	.4984+05	.4865+05	.4788+05	.4729+05	.4681+05
SPECIFIC POWER (KW/KG)	.207	.196	.186	.178	.172	.167
SPECIFIC WEIGHT (KG/KW)	4.8	5.1	5.4	5.6	5.8	6.0
BLANKET - MAST CLEARANCE (IN)	12.7	12.6	12.5	12.4	12.4	12.3
* BOOM PROPERTIES *						
DIAMETER (IN)	4.56	6.05	7.29	8.10	8.73	9.26
EI (LB-IN-SQ)	.14746+06	.45550+06	.93251+06	.14210+07	.19182+07	.24224+07
ROOT SPRING (LB-IN/RAD)	.5486+04	.1278+05	.2188+05	.3000+05	.3757+05	.4476+05
BUCKLING CAPABILITY RATIO	27.80	16.29	11.85	9.76	8.50	7.64
STRENGTH CAPABILITY RATIO	1.04	2.31	3.87	5.14	6.25	7.27
* CANNISTER PROPERTIES *						
HEIGHT (IN)	25.03	27.31	28.75	29.98	30.94	31.74
DIAMETER (IN)	5.38	7.13	8.61	9.56	10.31	10.93
* WEIGHTS (LB) *						
ARRAY	84.8	89.6	94.6	98.7	102.1	105.2
BOOM	2.6	4.6	6.6	8.2	9.6	10.8
CANNISTER	3.2	5.5	8.0	9.9	11.5	13.0
TENSION MECHANISM	1.1	1.2	1.5	1.9	2.1	2.3
MAST SLEEVE	1.7	2.0	2.3	2.5	2.6	2.8
SHAFT	1.0	1.0	1.0	1.0	1.0	1.0
HEADER	2.2	2.2	2.2	2.3	2.3	2.3
DRUM BEARING	1.5	1.5	1.6	1.6	1.6	1.7
CENTER SUPPORT	5.4	5.5	5.5	5.5	5.5	5.5
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.0	7.0	7.0	7.0	7.0	7.0
LEADING EDGE MEMBERS	1.3	1.3	1.3	1.3	1.3	1.3
DRUMS	7.6	7.5	7.4	7.4	7.3	7.3
LATCHES	.1	.1	.1	.1	.1	.1

ARRAY TYPE GE ROLLOUT POWER/WING = 8.0 KW ARRAY WIDTH = 3.50 M

BLANKET AREA = .88889+05 IN-SQ BLANKET WEIGHT = 48.8 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.024	.041	.057	.070	.080	.089
***** TORSIONAL FREQUENCY HZ *****	.024	.041	.057	.070	.080	.089
***** BENDING FREQUENCY HZ *****	.049	.085	.119	.145	.167	.187
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	54.1	53.5	53.0	52.7	52.5	52.3
ARRAY LENGTH (M)	20.88	21.11	21.29	21.42	21.51	21.59
ASPECT RATIO	5.97	6.03	6.08	6.12	6.15	6.17
ARRAY MASS (KG)	38.6	40.2	41.9	43.3	44.5	45.5
ARRAY WEIGHT (LB)	85.0	88.5	92.2	95.3	97.8	100.2
CENTER OF GRAVITY (IN)	289.1	287.6	285.4	283.1	281.5	279.9
TENSION PER BLANKET (LB)	.50	1.50	3.00	4.50	6.00	7.50
MOMENT OF INERTIA I1	.1436+08	.1503+08	.1567+08	.1615+08	.1655+08	.1691+08
MOMENT OF INERTIA I2	.7991+05	.7810+05	.7671+05	.7582+05	.7512+05	.7456+05
SPECIFIC POWER (KW/KG)	.207	.199	.191	.185	.180	.176
SPECIFIC WEIGHT (KG/KW)	4.8	5.0	5.2	5.4	5.6	5.7
BLANKET - MAST CLEARANCE (IN)	12.9	12.8	12.7	12.7	12.6	12.6
* BOOM PROPERTIES *						
DIAMETER (IN)	3.97	5.30	6.34	7.03	7.57	8.02
EI (LB-IN-SQ)	.97837+05	.29992+06	.61025+06	.92607+06	.12460+07	.15692+07
ROOT SPRING (LB-IN/RAD)	.4033+04	.9343+04	.1592+05	.2176+05	.2719+05	.3232+05
BUCKLING CAPABILITY RATIO	21.11	12.54	8.94	7.35	6.39	5.74
STRENGTH CAPABILITY RATIO	.85	1.96	3.23	4.31	5.27	6.16
* CANNISTER PROPERTIES *						
HEIGHT (IN)	22.25	23.91	25.52	26.60	27.45	28.15
DIAMETER (IN)	4.69	6.26	7.48	8.30	8.94	9.47
* WEIGHTS (LB) *						
ARRAY	85.0	88.5	92.2	95.3	97.8	100.2
BOOM	1.8	3.2	4.6	5.7	6.7	7.5
CANNISTER	2.4	4.3	6.1	7.6	8.8	9.9
TENSION MECHANISM	1.0	1.1	1.4	1.7	1.9	2.1
MAST SLEEVE	1.4	1.6	1.8	1.9	2.0	2.1
SHAFT	1.0	1.0	1.0	1.1	1.1	1.1
HEADER	2.2	2.2	2.3	2.3	2.3	2.3
DRUM BEARING	1.5	1.5	1.6	1.6	1.6	1.7
CENTER SUPPORT	5.4	5.5	5.5	5.5	5.6	5.6
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.0	7.0	7.0	7.0	7.0	7.0
LEADING EDGE MEMBERS	1.7	1.6	1.6	1.6	1.6	1.6
DRUMS	9.3	9.2	9.1	9.1	9.0	9.0
LATCHES	.1	.1	.1	.1	.1	.1

ARRAY TYPE GE ROLLOUT   POWER/WING = 8.0 KW   ARRAY WIDTH = 4.00 M

BLANKET AREA = .88889+05 IN=SQ   BLANKET WEIGHT = 48.8 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.026	.045	.063	.076	.088	.097
***** TORSIONAL FREQUENCY HZ *****	.026	.045	.063	.076	.088	.097
***** BENDING FREQUENCY HZ *****	.053	.092	.130	.159	.183	.204
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	64.1	63.5	63.1	62.8	62.6	62.4
ARRAY LENGTH (M)	17.62	17.77	17.89	17.97	18.03	18.09
ASPECT RATIO	4.41	4.44	4.47	4.49	4.51	4.52
ARRAY MASS (KG)	39.0	40.3	41.7	42.8	43.7	44.6
ARRAY WEIGHT (LB)	85.8	88.7	91.6	94.1	96.2	98.1
CENTER OF GRAVITY (IN)	241.3	240.1	238.2	236.3	234.7	233.2
TENSION PER BLANKET (LB)	.50	1.50	3.00	4.50	6.00	7.50
MOMENT OF INERTIA I1	.1026+08	.1063+08	.1097+08	.1123+08	.1144+08	.1163+08
MOMENT OF INERTIA I2	.1157+06	.1136+06	.1121+06	.1111+06	.1103+06	.1096+06
SPECIFIC POWER (KW/KG)	.205	.199	.192	.187	.183	.179
SPECIFIC WEIGHT (KG/KW)	4.9	5.0	5.2	5.3	5.5	5.6
BLANKET - MAST CLEARANCE (IN)	12.9	12.9	12.8	12.8	12.7	12.7
* BOOM PROPERTIES *						
DIAMETER (IN)	3.59	4.74	5.65	6.27	6.81	7.21
EI (LB-IN-SQ)	.69692+05	.21260+06	.43090+06	.65216+06	.87562+06	.11009+07
ROOT SPRING (LB-IN/RAD)	.3127+04	.7218+04	.1226+05	.1673+05	.2087+05	.2478+05
BUCKLING CAPABILITY RATIO	17.19	10.01	7.12	5.84	5.17	4.64
STRENGTH CAPABILITY RATIO	.74	1.67	2.77	3.71	4.68	5.48
* CANNISTER PROPERTIES *						
HEIGHT (IN)	19.88	21.75	23.24	24.24	24.59	25.23
DIAMETER (IN)	4.23	5.59	6.67	7.40	8.04	8.51
* WEIGHTS (LB) *						
ARRAY	85.8	88.7	91.6	94.1	96.2	98.1
BOOM	1.4	2.4	3.4	4.3	4.9	5.5
CANNISTER	2.0	3.5	5.0	6.1	7.2	8.0
TENSION MECHANISM	1.0	1.1	1.3	1.6	1.7	1.9
MAST SLEEVE	1.2	1.3	1.5	1.6	1.7	1.7
SHAFT	1.0	1.0	1.1	1.1	1.2	1.2
HEADER	2.2	2.3	2.3	2.3	2.3	2.4
DRUM BEARING	1.5	1.5	1.6	1.6	1.6	1.7
CENTER SUPPORT	5.5	5.5	5.6	5.6	5.7	5.8
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.0	7.0	7.0	7.0	7.0	7.0
LEADING EDGE MEMBERS	2.0	1.9	1.9	1.9	1.9	1.9
DRUMS	11.0	10.9	10.8	10.8	10.8	10.7
LATCHES	.1	.1	.1	.1	.1	.1

ARRAY TYPE GE ROLLOUT   POWER/WING = 8.0 KW   ARRAY WIDTH = 4.50 M

BLANKET AREA = .88889+05 IN-SQ   BLANKET WEIGHT = 48.8 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.028	.047	.067	.081	.093	.104
***** TORSIONAL FREQUENCY HZ *****	.028	.047	.067	.081	.093	.104
***** BENDING FREQUENCY HZ *****	.057	.099	.140	.171	.197	.220
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	74.0	73.5	73.1	72.9	72.6	72.5
ARRAY LENGTH (M)	15.25	15.36	15.44	15.50	15.54	15.58
ASPECT RATIO	3.39	3.41	3.43	3.44	3.45	3.46
ARRAY MASS (KG)	40.1	41.1	42.2	43.2	43.9	44.6
ARRAY WEIGHT (LB)	88.1	90.4	92.9	94.9	96.6	98.2
CENTER OF GRAVITY (IN)	206.1	205.2	203.9	202.5	201.5	200.5
TENSION PER BLANKET (LB)	.50	1.50	3.00	4.50	6.00	7.50
MOMENT OF INERTIA I1	.7857+07	.8083+07	.8293+07	.8451+07	.8584+07	.8701+07
MOMENT OF INERTIA I2	.1594+06	.1571+06	.1554+06	.1543+06	.1534+06	.1527+06
SPECIFIC POWER (KW/KG)	.200	.195	.189	.185	.182	.179
SPECIFIC WEIGHT (KG/KW)	5.0	5.1	5.3	5.4	5.5	5.6
BLANKET - MAST CLEARANCE (IN)	12.9	12.9	12.9	12.8	12.8	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	3.31	4.36	5.20	5.77	6.21	6.57
EI (LB-IN-SQ)	.52205+05	.15875+06	.32092+06	.48486+06	.65012+06	.81643+06
ROOT SPRING (LB-IN/RAD)	.2518+04	.5798+04	.9829+04	.1339+05	.1669+05	.1980+05
BUCKLING CAPABILITY RATIO	14.61	8.49	6.04	4.95	4.30	3.85
STRENGTH CAPABILITY RATIO	.66	1.50	2.49	3.34	4.11	4.82
* CANNISTER PROPERTIES *						
HEIGHT (IN)	17.88	19.62	21.01	21.94	22.66	23.26
DIAMETER (IN)	3.90	5.15	6.14	6.81	7.33	7.76
* WEIGHTS (LB) *						
ARRAY	88.1	90.4	92.9	94.9	96.6	98.2
BOOM	1.0	1.8	2.6	3.2	3.7	4.2
CANNISTER	1.7	3.0	4.2	5.2	6.0	6.8
TENSION MECHANISM	1.0	1.0	1.2	1.5	1.6	1.8
MAST SLEEVE	1.0	1.2	1.3	1.4	1.4	1.5
SHAFT	1.0	1.0	1.1	1.2	1.3	1.4
HEADER	2.6	2.6	2.6	2.7	2.7	2.8
DRUM BEARING	1.5	1.5	1.6	1.6	1.6	1.7
CENTER SUPPORT	6.0	6.0	5.9	5.9	5.9	5.9
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.0	7.0	7.0	7.0	7.0	7.0
LEADING EDGE MEMBERS	2.3	2.2	2.2	2.2	2.2	2.2
DRUMS	12.7	12.6	12.5	12.5	12.5	12.4
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 8.0 KW ARRAY WIDTH = 5.00 M

BLANKET AREA = .88889+05 IN-SQ BLANKET WEIGHT = 48.8 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.029	.050	.070	.086	.099	.110
***** TORSIONAL FREQUENCY HZ *****	.029	.050	.070	.086	.099	.110
***** BENDING FREQUENCY HZ *****	.061	.106	.149	.182	.210	.235
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	83.9	83.5	83.1	82.8	82.6	82.5
ARRAY LENGTH (M)	13.45	13.53	13.59	13.63	13.66	13.69
ASPECT RATIO	2.69	2.71	2.72	2.73	2.73	2.74
ARRAY MASS (KG)	40.8	41.7	42.7	43.5	44.2	44.8
ARRAY WEIGHT (LB)	89.8	91.8	93.9	95.8	97.3	98.7
CENTER OF GRAVITY (IN)	179.1	178.4	177.3	176.1	175.3	174.4
TENSION PER BLANKET (LB)	.50	1.50	3.00	4.50	6.00	7.50
MOMENT OF INERTIA I1	.6165+07	.6312+07	.6449+07	.6554+07	.6642+07	.6721+07
MOMENT OF INERTIA I2	.2111+06	.2086+06	.2066+06	.2054+06	.2045+06	.2037+06
SPECIFIC POWER (KW/KG)	.196	.192	.187	.184	.181	.178
SPECIFIC WEIGHT (KG/KW)	5.1	5.2	5.3	5.4	5.5	5.6
BLANKET - MAST CLEARANCE (IN)	13.0	12.9	12.9	12.9	12.9	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	3.08	4.06	4.84	5.36	5.77	6.10
EI (LB-IN-SQ)	.40590+05	.12315+06	.24852+06	.37504+06	.50239+06	.63043+06
ROOT SPRING (LB-IN/RAD)	.2085+04	.4793+04	.8114+04	.1105+05	.1376+05	.1631+05
BUCKLING CAPABILITY RATIO	12.64	7.34	5.21	4.27	3.71	3.32
STRENGTH CAPABILITY RATIO	.60	1.36	2.27	3.05	3.76	4.42
* CANNISTER PROPERTIES *						
HEIGHT (IN)	16.39	18.04	19.35	20.23	20.91	21.48
DIAMETER (IN)	3.63	4.79	5.71	6.33	6.81	7.20
* WEIGHTS (LB) *						
ARRAY	89.8	91.8	93.9	95.8	97.3	98.7
BOOM	.8	1.4	2.1	2.5	2.9	3.3
CANNISTER	1.5	2.6	3.7	4.5	5.2	5.9
TENSION MECHANISM	.9	1.0	1.2	1.5	1.6	1.7
MAST SLEEVE	.9	1.0	1.1	1.2	1.3	1.3
SHAFT	1.0	1.1	1.2	1.4	1.5	1.6
HEADER	2.6	2.6	2.7	2.7	2.8	2.8
DRUM BEARING	1.5	1.5	1.6	1.6	1.6	1.7
CENTER SUPPORT	6.2	6.2	6.2	6.2	6.2	6.2
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.0	7.0	7.0	7.0	7.0	7.0
LEADING EDGE MEMBERS	2.6	2.6	2.5	2.5	2.5	2.5
DRUMS	14.4	14.3	14.2	14.2	14.2	14.1
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 8.0 KW   ARRAY WIDTH = 5.50 M

BLANKET AREA = .88889+05 IN=SQ   BLANKET WEIGHT = 48.8 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.031	.053	.074	.090	.104	.116
***** TORSIONAL FREQUENCY HZ *****	.031	.053	.074	.090	.104	.116
***** BENDING FREQUENCY HZ *****	.065	.112	.158	.193	.222	.249
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	93.9	93.4	93.1	92.8	92.6	92.5
ARRAY LENGTH (M)	12.03	12.09	12.13	12.16	12.19	12.21
ASPECT RATIO	2.19	2.20	2.21	2.21	2.22	2.22
ARRAY MASS (KG)	41.7	42.5	43.4	44.1	44.8	45.4
ARRAY WEIGHT (LB)	91.8	93.5	95.4	97.1	98.5	99.8
CENTER OF GRAVITY (IN)	157.7	157.3	156.3	155.3	154.5	153.8
TENSION PER BLANKET (LB)	.50	1.50	3.00	4.50	6.00	7.50
MOMENT OF INERTIA I1	.4981+07	.5083+07	.5179+07	.5253+07	.5316+07	.5373+07
MOMENT OF INERTIA I2	.2717+06	.2689+06	.2668+06	.2655+06	.2645+06	.2637+06
SPECIFIC POWER (KW/KG)	.192	.188	.184	.181	.179	.176
SPECIFIC WEIGHT (KG/KW)	5.2	5.3	5.4	5.5	5.6	5.7
BLANKET - MAST CLEARANCE (IN)	13.0	13.0	12.9	12.9	12.9	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	2.88	3.80	4.53	5.02	5.40	5.71
EI (LB=IN=SQ)	.32459+05	.98311+05	.19811+06	.29868+06	.39981+06	.50140+06
ROOT SPRING (LB=IN/RAD)	.1763+04	.4047+04	.6846+04	.9314+04	.1159+05	.1374+05
BUCKLING CAPABILITY RATIO	11.10	6.44	4.57	3.74	3.25	2.91
STRENGTH CAPABILITY RATIO	.55	1.25	2.08	2.80	3.45	4.06
* CANNISTER PROPERTIES *						
HEIGHT (IN)	15.23	16.82	18.08	18.93	19.59	20.13
DIAMETER (IN)	3.40	4.48	5.34	5.92	6.37	6.74
* WEIGHTS (LB) *						
ARRAY	91.8	93.5	95.4	97.1	98.5	99.8
BOOM	.7	1.2	1.7	2.1	2.4	2.7
CANNISTER	1.3	2.3	3.3	4.0	4.6	5.2
TENSION MECHANISM	.9	1.0	1.2	1.4	1.5	1.7
MAST SLEEVE	.8	.9	1.0	1.1	1.1	1.2
SHAFT	1.1	1.1	1.3	1.5	1.7	1.9
HEADER	2.6	2.6	2.7	2.8	2.8	2.9
DRUM BEARING	1.5	1.5	1.6	1.6	1.6	1.7
CENTER SUPPORT	6.5	6.5	6.5	6.5	6.5	6.5
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.0	7.0	7.0	7.0	7.0	7.0
LEADING EDGE MEMBERS	2.9	2.9	2.8	2.8	2.8	2.8
DRUMS	16.1	16.0	15.9	15.9	15.9	15.8
LATCHES	.3	.3	.3	.3	.3	.3

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE GE ROLLOUT   POWER/WING = 8.0 KW   ARRAY WIDTH = 6.00 M

BLANKET AREA = .88889+05 IN=SQ   BLANKET WEIGHT = 48.8 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.032	.055	.077	.094	.109	.121
***** TORSIONAL FREQUENCY HZ *****	.032	.055	.077	.094	.109	.121
***** BENDING FREQUENCY HZ *****	.068	.117	.166	.203	.234	.262
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	103.8	103.3	103.0	102.8	102.6	102.4
ARRAY LENGTH (M)	10.88	10.93	10.96	10.99	11.00	11.02
ASPECT RATIO	1.81	1.82	1.83	1.83	1.83	1.84
ARRAY MASS (KG)	42.8	43.4	44.2	44.9	45.5	46.1
ARRAY WEIGHT (LB)	94.1	95.5	97.2	98.8	100.1	101.4
CENTER OF GRAVITY (IN)	140.2	139.9	139.3	138.4	137.7	137.0
TENSION PER BLANKET (LB)	.50	1.50	3.00	4.50	6.00	7.50
MOMENT OF INERTIA I1	.4121+07	.4194+07	.4265+07	.4321+07	.4369+07	.4413+07
MOMENT OF INERTIA I2	.3414+06	.3384+06	.3361+06	.3347+06	.3337+06	.3329+06
SPECIFIC POWER (KW/KG)	.187	.184	.181	.178	.176	.174
SPECIFIC WEIGHT (KG/KW)	5.3	5.4	5.5	5.6	5.7	5.8
BLANKET = MAST CLEARANCE (IN)	13.0	13.0	13.0	13.0	13.0	13.0
* BOOM PROPERTIES *						
DIAMETER (IN)	2.74	3.61	4.30	4.77	5.13	5.43
EI (LB=IN=SQ)	.26559+05	.80337+05	.16173+06	.24366+06	.32599+06	.40864+06
ROOT SPRING (LB=IN/RAD)	.1517+04	.3479+04	.5879+04	.7995+04	.9946+04	.1178+05
BUCKLING CAPABILITY RATIO	10.04	5.82	4.13	3.38	2.93	2.63
STRENGTH CAPABILITY RATIO	.52	1.18	1.97	2.65	3.27	3.85
* CANNISTER PROPERTIES *						
HEIGHT (IN)	14.00	15.51	16.69	17.49	18.11	18.63
DIAMETER (IN)	3.23	4.26	5.08	5.63	6.05	6.40
* WEIGHTS (LB) *						
ARRAY	94.1	95.5	97.2	98.8	100.1	101.4
BOOM	.5	1.0	1.4	1.7	1.9	2.2
CANNISTER	1.2	2.1	2.9	3.6	4.2	4.7
TENSION MECHANISM	.9	1.0	1.1	1.4	1.5	1.6
MAST SLEEVE	.8	.9	.9	1.0	1.0	1.1
SHAFT	1.4	1.4	1.5	1.7	2.0	2.3
HEADER	2.6	2.6	2.7	2.8	2.9	3.0
DRUM BEARING	1.5	1.5	1.6	1.6	1.6	1.7
CENTER SUPPORT	6.8	6.8	6.8	6.8	6.8	6.8
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.0	7.0	7.0	7.0	7.0	7.0
LEADING EDGE MEMBERS	3.2	3.2	3.2	3.1	3.1	3.1
DRUMS	17.7	17.7	17.6	17.6	17.5	17.5
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 10.0 KW   ARRAY WIDTH = 3.00 M

BLANKET AREA = .11111+06 IN=SQ   BLANKET WEIGHT = 61.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.018	.030	.041	.050	.057	.063
***** TORSIONAL FREQUENCY HZ *****	.018	.030	.041	.050	.057	.063
***** BENDING FREQUENCY HZ *****	.035	.061	.085	.104	.119	.133
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	43.7	43.0	42.4	42.0	41.7	41.4
ARRAY LENGTH (M)	32.28	32.84	33.29	33.60	33.84	34.04
ASPECT RATIO	10.76	10.95	11.10	11.20	11.28	11.35
ARRAY MASS (KG)	45.5	48.6	51.8	54.4	56.5	58.5
ARRAY WEIGHT (LB)	100.1	106.9	113.9	119.6	124.3	128.7
CENTER OF GRAVITY (IN)	470.6	467.9	464.1	460.2	456.6	454.0
TENSION PER BLANKET (LB)	.50	1.50	3.00	4.50	6.00	7.50
MOMENT OF INERTIA I1	.4189+08	.4518+08	.4835+08	.5080+08	.5277+08	.5462+08
MOMENT OF INERTIA I2	.6099+05	.5886+05	.5723+05	.5618+05	.5536+05	.5470+05
SPECIFIC POWER (KW/KG)	.220	.206	.193	.184	.177	.171
SPECIFIC WEIGHT (KG/KW)	4.5	4.9	5.2	5.4	5.7	5.8
BLANKET - MAST CLEARANCE (IN)	12.7	12.5	12.4	12.3	12.2	12.1
* BOOM PROPERTIES *						
DIAMETER (IN)	5.34	7.14	8.55	9.51	10.34	10.97
EI (LB-IN-SQ)	.23378+06	.72568+06	.14915+07	.22791+07	.30830+07	.39004+07
ROOT SPRING (LB-IN/RAD)	.7750+04	.1813+05	.3111+05	.4276+05	.5364+05	.6398+05
BUCKLING CAPABILITY RATIO	38.09	22.74	16.30	13.43	11.91	10.72
STRENGTH CAPABILITY RATIO	1.08	2.44	3.96	5.22	6.51	7.55
* CANNISTER PROPERTIES *						
HEIGHT (IN)	28.61	30.82	32.89	34.29	35.01	35.92
DIAMETER (IN)	6.30	8.43	10.09	11.22	12.20	12.94
* WEIGHTS (LB) *						
ARRAY	100.1	106.9	113.9	119.6	124.3	128.7
BOOM	3.8	6.7	9.7	12.1	13.9	15.8
CANNISTER	4.3	7.6	10.9	13.5	15.9	17.9
TENSION MECHANISM	1.1	1.3	1.6	2.1	2.3	2.6
MAST SLEEVE	2.3	2.7	3.1	3.4	3.6	3.8
SHAFT	.9	1.0	1.0	1.0	1.0	1.0
HEADER	2.2	2.2	2.2	2.3	2.3	2.3
DRUM BEARING	1.5	1.5	1.6	1.6	1.6	1.7
CENTER SUPPORT	5.4	5.4	5.5	5.5	5.5	5.5
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.2	7.2	7.2	7.2	7.2	7.2
LEADING EDGE MEMBERS	1.3	1.3	1.3	1.3	1.3	1.3
DRUMS	7.6	7.5	7.4	7.3	7.3	7.2
LATCHES	.1	.1	.1	.1	.1	.1

ORIGINAL PAGE IS
OF POOR QUALITY

ARRAY TYPE GE ROLLOUT POWER/WING = 10.0 KW ARRAY WIDTH = 3.50 M

BLANKET AREA = .11111+06 IN-SQ BLANKET WEIGHT = 61.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.019	.033	.046	.056	.065	.072
***** TORSIONAL FREQUENCY HZ *****	.019	.033	.046	.056	.065	.072
***** BENDING FREQUENCY HZ *****	.039	.067	.095	.116	.133	.149
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	53.8	53.1	52.6	52.2	52.0	51.7
ARRAY LENGTH (M)	26.24	26.57	26.83	27.01	27.15	27.27
ASPECT RATIO	7.50	7.59	7.67	7.72	7.76	7.79
ARRAY MASS (KG)	45.2	47.5	49.8	51.7	53.3	54.7
ARRAY WEIGHT (LB)	99.5	104.4	109.5	113.7	117.2	120.4
CENTER OF GRAVITY (IN)	379.9	378.0	374.9	371.8	369.7	367.6
TENSION PER BLANKET (LB)	.50	1.50	3.00	4.50	6.00	7.50
MOMENT OF INERTIA I1	.2743+08	.2898+08	.3044+08	.3155+08	.3249+08	.3332+08
MOMENT OF INERTIA I2	.9477+05	.9231+05	.9043+05	.8921+05	.8826+05	.8750+05
SPECIFIC POWER (KW/KG)	.221	.211	.201	.193	.188	.183
SPECIFIC WEIGHT (KG/KW)	4.5	4.7	5.0	5.2	5.3	5.5
BLANKET - MAST CLEARANCE (IN)	12.8	12.7	12.6	12.6	12.5	12.5
* BOOM PROPERTIES *						
DIAMETER (IN)	4.65	6.16	7.36	8.18	8.81	9.34
EI (LB-IN-SQ)	.15442+06	.47498+06	.96905+06	.14732+07	.19850+07	.25029+07
ROOT SPRING (LB-IN/RAD)	.5679+04	.1319+05	.2252+05	.3083+05	.3855+05	.4587+05
BUCKLING CAPABILITY RATIO	28.94	16.92	12.08	9.93	8.65	7.77
STRENGTH CAPABILITY RATIO	.89	1.98	3.25	4.32	5.28	6.15
* CANNISTER PROPERTIES *						
HEIGHT (IN)	25.18	27.42	29.22	30.43	31.37	32.16
DIAMETER (IN)	5.49	7.27	8.69	9.65	10.40	11.02
* WEIGHTS (LB) *						
ARRAY	99.5	104.4	109.5	113.7	117.2	120.4
BOOM	2.7	4.7	6.8	8.5	9.9	11.2
CANNISTER	3.3	5.7	8.2	10.1	11.7	13.2
TENSION MECHANISM	1.1	1.2	1.5	1.9	2.1	2.3
MAST SLEEVE	1.8	2.1	2.4	2.6	2.7	2.8
SHAFT	1.0	1.0	1.0	1.0	1.1	1.1
HEADER	2.2	2.2	2.3	2.3	2.3	2.3
DRUM BEARING	1.5	1.5	1.6	1.6	1.6	1.7
CENTER SUPPORT	5.4	5.5	5.5	5.5	5.6	5.6
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.2	7.2	7.2	7.2	7.2	7.2
LEADING EDGE MEMBERS	1.6	1.6	1.6	1.6	1.6	1.6
DRUMS	9.3	9.2	9.1	9.0	9.0	9.0
LATCHES	.1	.1	.1	.1	.1	.1

ARRAY TYPE GE ROLLOUT POWER/WING = 10.0 KW ARRAY WIDTH = 4.00 M

BLANKET AREA = .11111+06 IN-SQ BLANKET WEIGHT = 61.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.021	.036	.051	.062	.071	.079
***** TORSIONAL FREQUENCY HZ *****	.021	.036	.051	.062	.071	.079
***** BENDING FREQUENCY HZ *****	.043	.073	.104	.126	.146	.163
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	63.8	63.2	62.7	62.4	62.1	61.9
ARRAY LENGTH (M)	22.12	22.33	22.50	22.62	22.71	22.79
ASPECT RATIO	5.53	5.58	5.63	5.66	5.68	5.70
ARRAY MASS (KG)	45.4	47.1	49.0	50.5	51.7	52.9
ARRAY WEIGHT (LB)	99.8	103.7	107.7	111.1	113.8	116.4
CENTER OF GRAVITY (IN)	317.7	315.9	313.3	310.7	308.9	307.1
TENSION PER BLANKET (LB)	.50	1.50	3.00	4.50	6.00	7.50
MOMENT OF INERTIA I1	.1949+08	.2031+08	.2109+08	.2168+08	.2217+08	.2260+08
MOMENT OF INERTIA I2	.1368+06	.1340+06	.1319+06	.1305+06	.1295+06	.1286+06
SPECIFIC POWER (KW/KG)	.220	.212	.204	.198	.193	.189
SPECIFIC WEIGHT (KG/KW)	4.5	4.7	4.9	5.0	5.2	5.3
BLANKET - MAST CLEARANCE (IN)	12.9	12.8	12.8	12.7	12.7	12.7
* BOOM PROPERTIES *						
DIAMETER (IN)	4.13	5.50	6.57	7.29	7.85	8.31
EI (LB-IN-SQ)	.10975+06	.33568+06	.68175+06	.10333+07	.13888+07	.17477+07
ROOT SPRING (LB-IN/RAD)	.4396+04	.1017+05	.1730+05	.2363+05	.2949+05	.3504+05
BUCKLING CAPABILITY RATIO	22.76	13.50	9.62	7.90	6.87	6.16
STRENGTH CAPABILITY RATIO	.74	1.70	2.81	3.75	4.60	5.38
* CANNISTER PROPERTIES *						
HEIGHT (IN)	23.02	24.70	26.32	27.41	28.26	28.96
DIAMETER (IN)	4.87	6.50	7.75	8.60	9.26	9.81
* WEIGHTS (LB) *						
ARRAY	99.8	103.7	107.7	111.1	113.8	116.4
BOOM	2.0	3.5	5.1	6.3	7.3	8.2
CANNISTER	2.6	4.6	6.6	8.1	9.4	10.5
TENSION MECHANISM	1.0	1.1	1.4	1.7	1.9	2.1
MAST SLEEVE	1.5	1.7	1.9	2.1	2.2	2.3
SHAFT	1.0	1.0	1.1	1.1	1.2	1.2
HEADER	2.2	2.3	2.3	2.3	2.3	2.3
DRUM BEARING	1.5	1.5	1.6	1.6	1.6	1.7
CENTER SUPPORT	5.5	5.5	5.6	5.6	5.7	5.8
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.2	7.2	7.2	7.2	7.2	7.2
LEADING EDGE MEMBERS	2.0	1.9	1.9	1.9	1.9	1.9
DRUMS	11.0	10.9	10.8	10.8	10.7	10.7
LATCHES	.1	.1	.1	.1	.1	.1

ARRAY TYPE GE ROLLOUT   POWER/WING = 10.0 KW   ARRAY WIDTH = 4.50 M

BLANKET AREA = .11111+06 IN-SQ   BLANKET WEIGHT = 61.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.022	.039	.054	.066	.076	.085
***** TORSIONAL FREQUENCY HZ *****	.022	.039	.054	.066	.076	.085
***** BENDING FREQUENCY HZ *****	.046	.079	.112	.136	.157	.175
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	73.8	73.2	72.8	72.5	72.2	72.0
ARRAY LENGTH (M)	19.12	19.27	19.39	19.47	19.53	19.59
ASPECT RATIO	4.25	4.28	4.31	4.33	4.34	4.35
ARRAY MASS (KG)	46.3	47.8	49.3	50.5	51.5	52.4
ARRAY WEIGHT (LB)	102.0	105.1	108.4	111.1	113.3	115.4
CENTER OF GRAVITY (IN)	271.2	270.0	268.3	266.4	265.1	263.4
TENSION PER BLANKET (LB)	.50	1.50	3.00	4.50	6.00	7.50
MOMENT OF INERTIA I1	.1480+08	.1531+08	.1577+08	.1613+08	.1643+08	.1667+08
MOMENT OF INERTIA I2	.1880+06	.1849+06	.1826+06	.1811+06	.1799+06	.1790+06
SPECIFIC POWER (KW/KG)	.216	.209	.203	.198	.194	.191
SPECIFIC WEIGHT (KG/KW)	4.6	4.8	4.9	5.0	5.2	5.2
BLANKET - MAST CLEARANCE (IN)	12.9	12.9	12.8	12.8	12.8	12.7
* BOOM PROPERTIES *						
DIAMETER (IN)	3.77	4.98	5.94	6.59	7.09	7.57
EI (LB-IN-SQ)	.82056+05	.25000+06	.50617+06	.76555+06	.10273+07	.12910+07
ROOT SPRING (LB-IN/RAD)	.3534+04	.8150+04	.1383+05	.1887+05	.2352+05	.2792+05
BUCKLING CAPABILITY RATIO	18.99	11.05	7.86	6.44	5.60	5.11
STRENGTH CAPABILITY RATIO	.65	1.45	2.41	3.23	3.97	4.78
* CANNISTER PROPERTIES *						
HEIGHT (IN)	20.96	22.87	24.39	25.42	26.21	26.44
DIAMETER (IN)	4.45	5.88	7.01	7.77	8.36	8.94
* WEIGHTS (LB) *						
ARRAY	102.0	105.1	108.4	111.1	113.3	115.4
BOOM	1.6	2.8	4.0	4.9	5.7	6.3
CANNISTER	2.2	3.8	5.5	6.7	7.8	8.8
TENSION MECHANISM	1.0	1.1	1.3	1.6	1.8	2.0
MAST SLEEVE	1.3	1.5	1.6	1.7	1.8	1.9
SHAFT	1.0	1.0	1.1	1.2	1.3	1.4
HEADER	2.6	2.6	2.6	2.7	2.7	2.8
DRUM BEARING	1.5	1.5	1.6	1.6	1.6	1.7
CENTER SUPPORT	6.1	6.1	6.1	6.1	6.1	6.1
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.2	7.2	7.2	7.2	7.2	7.2
LEADING EDGE MEMBERS	2.3	2.2	2.2	2.2	2.2	2.2
DRUMS	12.7	12.6	12.5	12.5	12.4	12.4
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 10.0 KW   ARRAY WIDTH = 5.00 M

BLANKET AREA = .11111+06 IN=SQ   BLANKET WEIGHT = 61.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.024	.041	.058	.070	.081	.090
***** TORSIONAL FREQUENCY HZ *****	.024	.041	.058	.070	.081	.090
***** BENDING FREQUENCY HZ *****	.049	.084	.119	.145	.168	.187
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	83.7	83.2	82.8	82.5	82.3	82.1
ARRAY LENGTH (M)	16.85	16.96	17.05	17.10	17.15	17.19
ASPECT RATIO	3.37	3.39	3.41	3.42	3.43	3.44
ARRAY MASS (KG)	47.1	48.2	49.5	50.6	51.5	52.3
ARRAY WEIGHT (LB)	103.5	106.1	109.0	111.3	113.3	115.1
CENTER OF GRAVITY (IN)	235.8	234.9	233.4	231.8	230.7	229.6
TENSION PER BLANKET (LB)	.50	1.50	3.00	4.50	6.00	7.50
MOMENT OF INERTIA I1	.1156+08	.1188+08	.1218+08	.1241+08	.1260+08	.1277+08
MOMENT OF INERTIA I2	.2481+06	.2448+06	.2422+06	.2406+06	.2393+06	.2383+06
SPECIFIC POWER (KW/KG)	.213	.207	.202	.198	.194	.191
SPECIFIC WEIGHT (KG/KW)	4.7	4.8	5.0	5.1	5.1	5.2
BLANKET - MAST CLEARANCE (IN)	12.9	12.9	12.9	12.9	12.9	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	3.51	4.63	5.52	6.12	6.58	6.97
EI (LB-IN-SQ)	.63713+05	.19360+06	.39114+06	.59073+06	.79183+06	.99414+06
ROOT SPRING (LB-IN/RAD)	.2923+04	.6728+04	.1140+05	.1553+05	.1935+05	.2295+05
BUCKLING CAPABILITY RATIO	16.43	9.55	6.79	5.56	4.83	4.33
STRENGTH CAPABILITY RATIO	.59	1.33	2.21	2.97	3.65	4.28
* CANNISTER PROPERTIES *						
HEIGHT (IN)	19.12	20.92	22.34	23.30	24.04	24.66
DIAMETER (IN)	4.14	5.46	6.51	7.22	7.77	8.22
* WEIGHTS (LB) *						
ARRAY	103.5	106.1	109.0	111.3	113.3	115.1
BOOM	1.2	2.2	3.1	3.9	4.5	5.0
CANNISTER	1.9	3.3	4.7	5.8	6.7	7.5
TENSION MECHANISM	1.0	1.1	1.3	1.6	1.7	1.9
MAST SLEEVE	1.1	1.3	1.4	1.5	1.6	1.6
SHAFT	1.0	1.1	1.2	1.4	1.5	1.6
HEADER	2.6	2.6	2.7	2.7	2.8	2.8
DRUM BEARING	1.5	1.5	1.6	1.6	1.6	1.7
CENTER SUPPORT	6.4	6.4	6.4	6.4	6.4	6.4
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.2	7.2	7.2	7.2	7.2	7.2
LEADING EDGE MEMBERS	2.6	2.5	2.5	2.5	2.5	2.5
DRUMS	14.4	14.3	14.2	14.2	14.1	14.1
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 10.0 KW   ARRAY WIDTH = 5.50 M

BLANKET AREA = .11111+06 IN*SQ   BLANKET WEIGHT = 61.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.025	.043	.061	.074	.085	.095
***** TORSIONAL FREQUENCY HZ *****	.025	.043	.061	.074	.085	.095
***** BENDING FREQUENCY HZ *****	.052	.089	.126	.154	.178	.198
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	93.7	93.1	92.7	92.5	92.3	92.1
ARRAY LENGTH (M)	15.07	15.15	15.21	15.26	15.29	15.32
ASPECT RATIO	2.74	2.75	2.77	2.77	2.78	2.79
ARRAY MASS (KG)	48.0	49.0	50.0	51.0	51.8	52.6
ARRAY WEIGHT (LB)	105.5	107.7	110.1	112.2	114.0	115.6
CENTER OF GRAVITY (IN)	207.6	207.0	206.0	204.6	203.7	202.7
TENSION PER BLANKET (LB)	.50	1.50	3.00	4.50	6.00	7.50
MOMENT OF INERTIA I1	.9307+07	.9527+07	.9734+07	.9892+07	.1003+08	.1014+08
MOMENT OF INERTIA I2	.3181+06	.3144+06	.3115+06	.3098+06	.3084+06	.3073+06
SPECIFIC POWER (KW/KG)	.208	.204	.200	.196	.193	.190
SPECIFIC WEIGHT (KG/KW)	4.8	4.9	5.0	5.1	5.2	5.3
BLANKET - MAST CLEARANCE (IN)	13.0	13.0	12.9	12.9	12.9	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	3.28	4.33	5.17	5.73	6.16	6.52
EI (LB*IN*SQ)	.50930+05	.15446+06	.31161+06	.47013+06	.62967+06	.79003+06
ROOT SPRING (LB*IN/RAD)	.2471+04	.5680+04	.9615+04	.1309+05	.1630+05	.1932+05
BUCKLING CAPABILITY RATIO	14.43	8.37	5.95	4.87	4.23	3.79
STRENGTH CAPABILITY RATIO	.54	1.22	2.03	2.73	3.37	3.95
* CANNISTER PROPERTIES *						
HEIGHT (IN)	17.69	19.40	20.76	21.67	22.38	22.96
DIAMETER (IN)	3.88	5.12	6.10	6.76	7.27	7.69
* WEIGHTS (LB) *						
ARRAY	105.5	107.7	110.1	112.2	114.0	115.6
BOOM	1.0	1.8	2.5	3.1	3.6	4.1
CANNISTER	1.7	2.9	4.2	5.1	5.9	6.7
TENSION MECHANISM	1.0	1.0	1.2	1.5	1.6	1.8
MAST SLEEVE	1.0	1.1	1.3	1.3	1.4	1.5
SHAFT	1.3	1.3	1.3	1.5	1.7	1.9
HEADER	2.6	2.6	2.7	2.8	2.8	2.9
DRUM BEARING	1.5	1.5	1.6	1.6	1.6	1.7
CENTER SUPPORT	6.8	6.7	6.7	6.7	6.7	6.7
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.2	7.2	7.2	7.2	7.2	7.2
LEADING EDGE MEMBERS	2.9	2.8	2.8	2.8	2.8	2.8
DRUMS	16.1	16.0	15.9	15.9	15.8	15.8
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 10.0 KW   ARRAY WIDTH = 6.00 M

BLANKET AREA = .11111+06 IN-SQ   BLANKET WEIGHT = 61.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.026	.045	.064	.078	.089	.099
***** TORSIONAL FREQUENCY HZ *****	.026	.045	.064	.078	.089	.099
***** BENDING FREQUENCY HZ *****	.054	.094	.133	.162	.187	.209
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	103.6	103.1	102.7	102.5	102.3	102.1
ARRAY LENGTH (M)	13.62	13.69	13.74	13.77	13.80	13.82
ASPECT RATIO	2.27	2.28	2.29	2.30	2.30	2.30
ARRAY MASS (KG)	49.0	49.9	50.8	51.6	52.4	53.1
ARRAY WEIGHT (LB)	107.8	109.7	111.7	113.6	115.3	116.8
CENTER OF GRAVITY (IN)	184.7	184.3	183.6	182.6	181.7	180.8
TENSION PER BLANKET (LB)	.50	1.50	3.00	4.50	6.00	7.50
MOMENT OF INERTIA I1	.7673+07	.7830+07	.7980+07	.8096+07	.8195+07	.8284+07
MOMENT OF INERTIA I2	.3985+06	.3945+06	.3914+06	.3895+06	.3881+06	.3870+06
SPECIFIC POWER (KW/KG)	.204	.201	.197	.194	.191	.188
SPECIFIC WEIGHT (KG/KW)	4.9	5.0	5.1	5.2	5.2	5.3
BLANKET - MAST CLEARANCE (IN)	13.0	13.0	13.0	13.0	12.9	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	3.09	4.08	4.86	5.39	5.80	6.13
EI (LB-IN-SQ)	.41637+05	.12609+06	.25404+06	.38296+06	.51259+06	.64278+06
ROOT SPRING (LB-IN/RAD)	.2125+04	.4878+04	.8249+04	.1122+05	.1397+05	.1655+05
BUCKLING CAPABILITY RATIO	12.81	7.43	5.27	4.32	3.74	3.35
STRENGTH CAPABILITY RATIO	.50	1.13	1.88	2.52	3.11	3.66
* CANNISTER PROPERTIES *						
HEIGHT (IN)	16.56	18.21	19.52	20.39	21.07	21.64
DIAMETER (IN)	3.65	4.82	5.74	6.36	6.84	7.24
* WEIGHTS (LB) *						
ARRAY	107.8	109.7	111.7	113.6	115.3	116.8
BOOM	.8	1.5	2.1	2.6	3.0	3.4
CANNISTER	1.5	2.6	3.7	4.6	5.3	5.9
TENSION MECHANISM	.9	1.0	1.2	1.5	1.6	1.8
MAST SLEEVE	.9	1.0	1.1	1.2	1.3	1.3
SHAFT	1.6	1.6	1.6	1.7	2.0	2.3
HEADER	2.6	2.6	2.7	2.8	2.9	3.0
DRUM BEARING	1.5	1.5	1.6	1.6	1.6	1.7
CENTER SUPPORT	7.2	7.1	7.1	7.1	7.1	7.1
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.2	7.2	7.2	7.2	7.2	7.2
LEADING EDGE MEMBERS	3.2	3.2	3.1	3.1	3.1	3.1
DRUMS	17.7	17.7	17.6	17.6	17.5	17.5
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 15.0 KW ARRAY WIDTH = 3.00 M

BLANKET AREA = .16667+06 IN*SQ BLANKET WEIGHT = 91.5 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.012	.020	.027	.034	.040	.050
***** TORSIONAL FREQUENCY HZ *****	.012	.020	.027	.034	.040	.050
***** BENDING FREQUENCY HZ *****	.023	.040	.055	.071	.086	.109
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	42.9	42.0	40.2	39.3	38.5	37.3
ARRAY LENGTH (M)	49.29	50.44	52.69	53.90	54.99	56.74
ASPECT RATIO	16.43	16.81	17.56	17.97	18.33	18.91
ARRAY MASS (KG)	63.5	69.4	76.2	83.1	90.2	102.4
ARRAY WEIGHT (LB)	139.8	152.7	167.6	182.7	198.4	225.3
CENTER OF GRAVITY (IN)	760.8	755.7	764.0	758.1	754.4	748.0
TENSION PER BLANKET (LB)	.50	1.50	3.00	5.00	7.50	12.50
MOMENT OF INERTIA I1	.1422+09	.1578+09	.1827+09	.2020+09	.2226+09	.2585+09
MOMENT OF INERTIA I2	.8381+05	.7992+05	.7311+05	.6982+05	.6706+05	.6301+05
SPECIFIC POWER (KW/KG)	.236	.216	.197	.181	.166	.146
SPECIFIC WEIGHT (KG/KW)	4.2	4.6	5.1	5.5	6.0	6.8
BLANKET - MAST CLEARANCE (IN)	12.5	12.2	12.9	12.8	12.8	12.7
* BOOM PROPERTIES *						
DIAMETER (IN)	7.30	9.72	11.99	13.89	15.52	18.05
EI (LB*IN*SQ)	.54505+06	.17127+07	.37366+07	.65181+07	.10177+08	.18057+08
ROOT SPRING (LB*IN/RAD)	.1462+05	.3451+05	.6196+05	.9404+05	.1314+06	.2019+06
BUCKLING CAPABILITY RATIO	71.32	42.14	32.06	25.78	21.48	17.42
STRENGTH CAPABILITY RATIO	1.23	2.66	4.51	6.46	8.36	11.66
* CANNISTER PROPERTIES *						
HEIGHT (IN)	35.56	38.97	41.81	44.10	46.52	49.75
DIAMETER (IN)	8.62	11.47	14.15	16.39	18.32	21.29
* WEIGHTS (LB) *						
ARRAY	139.8	152.7	167.6	182.7	198.4	225.3
BOOM	7.2	13.0	19.5	26.0	33.2	44.9
CANNISTER	7.8	13.9	21.1	28.2	35.2	47.6
TENSION MECHANISM	1.3	1.6	2.0	2.8	3.6	5.2
MAST SLEEVE	3.9	4.8	5.9	6.7	7.4	8.6
SHAFT	.9	1.0	1.0	1.0	1.0	1.0
HEADER	2.2	2.2	2.2	2.3	2.3	2.3
DRUM BEARING	1.5	1.5	1.6	1.6	1.7	1.8
CENTER SUPPORT	5.4	5.4	5.5	5.5	5.5	5.5
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.6	7.6	7.6	7.6	7.6	7.6
LEADING EDGE MEMBERS	1.3	1.3	1.2	1.2	1.2	1.1
DRUMS	7.6	7.4	7.1	6.9	6.8	6.6
LATCHES	.1	.1	.1	.1	.1	.1

ARRAY TYPE GE ROLLOUT   POWER/WING = 15.0 KW   ARRAY WIDTH = 3.50 M

BLANKET AREA = .16667+06 IN-SQ   BLANKET WEIGHT = 91.5 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.013	.022	.031	.039	.048	.059
***** TORSIONAL FREQUENCY HZ *****	.013	.022	.031	.039	.048	.059
***** BENDING FREQUENCY HZ *****	.026	.045	.063	.080	.098	.124
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	53.1	52.2	51.5	50.9	50.4	48.6
ARRAY LENGTH (M)	39.86	40.53	41.08	41.55	41.99	43.56
ASPECT RATIO	11.39	11.58	11.74	11.87	12.00	12.45
ARRAY MASS (KG)	62.1	66.3	70.7	75.2	79.8	88.3
ARRAY WEIGHT (LB)	136.7	145.9	155.4	165.4	175.5	194.3
CENTER OF GRAVITY (IN)	616.0	611.3	605.4	598.8	591.0	591.9
TENSION PER BLANKET (LB)	.50	1.50	3.00	5.00	7.50	12.50
MOMENT OF INERTIA I1	.9136+08	.9836+08	.1051+09	.1118+09	.1184+09	.1361+09
MOMENT OF INERTIA I2	.1306+06	.1261+06	.1227+06	.1198+06	.1174+06	.1089+06
SPECIFIC POWER (KW/KG)	.241	.226	.212	.200	.188	.170
SPECIFIC WEIGHT (KG/KW)	4.1	4.4	4.7	5.0	5.3	5.9
BLANKET - MAST CLEARANCE (IN)	12.7	12.5	12.4	12.3	12.1	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	6.22	8.33	9.97	11.39	12.77	14.90
EI (LB-IN-SQ)	.35639+06	.11056+07	.22711+07	.38742+07	.59339+07	.10645+08
ROOT SPRING (LB-IN/RAD)	.1063+05	.2486+05	.4265+05	.6366+05	.8765+05	.1359+06
BUCKLING CAPABILITY RATIO	51.80	30.90	22.14	17.35	14.54	11.87
STRENGTH CAPABILITY RATIO	.96	2.16	3.52	4.99	6.72	9.61
* CANNISTER PROPERTIES *						
HEIGHT (IN)	31.95	34.43	36.71	38.70	40.11	43.04
DIAMETER (IN)	7.35	9.82	11.76	13.44	15.07	17.58
* WEIGHTS (LB) *						
ARRAY	136.7	145.9	155.4	165.4	175.5	194.3
BOOM	5.2	9.2	13.4	17.7	21.8	29.9
CANNISTER	5.7	10.2	14.7	19.2	24.1	32.7
TENSION MECHANISM	1.2	1.4	1.8	2.4	3.0	4.3
MAST SLEEVE	2.9	3.6	4.1	4.6	5.0	5.9
SHAFT	1.0	1.0	1.0	1.1	1.1	1.2
HEADER	2.2	2.2	2.3	2.3	2.3	2.4
DRUM BEARING	1.5	1.5	1.6	1.6	1.7	1.8
CENTER SUPPORT	5.4	5.5	5.5	5.5	5.6	5.7
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.6	7.6	7.6	7.6	7.6	7.6
LEADING EDGE MEMBERS	1.6	1.6	1.6	1.6	1.5	1.5
DRUMS	9.3	9.1	9.0	8.9	8.8	8.5
LATCHES	.1	.1	.1	.1	.1	.1

ARRAY TYPE GE ROLLOUT POWER/WING = 15.0 KW ARRAY WIDTH = 4.00 M

BLANKET AREA = .16667+06 IN=SQ BLANKET WEIGHT = 91.5 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.014	.025	.034	.044	.053	.067
***** TORSIONAL FREQUENCY HZ *****	.014	.025	.034	.044	.053	.067
***** BENDING FREQUENCY HZ *****	.028	.049	.069	.088	.107	.138
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	63.2	62.4	61.8	61.2	60.7	60.0
ARRAY LENGTH (M)	33.49	33.93	34.27	34.58	34.85	35.25
ASPECT RATIO	8.37	8.48	8.57	8.64	8.71	8.81
ARRAY MASS (KG)	61.6	64.9	68.2	71.6	75.2	81.0
ARRAY WEIGHT (LB)	135.6	142.7	150.0	157.6	165.4	178.2
CENTER OF GRAVITY (IN)	516.2	512.5	507.9	502.5	497.3	487.5
TENSION PER BLANKET (LB)	.50	1.50	3.00	5.00	7.50	12.50
MOMENT OF INERTIA I1	.6401+08	.6772+08	.7123+08	.7470+08	.7817+08	.8355+08
MOMENT OF INERTIA I2	.1883+06	.1833+06	.1795+06	.1763+06	.1735+06	.1697+06
SPECIFIC POWER (KW/KG)	.243	.231	.220	.209	.200	.185
SPECIFIC WEIGHT (KG/KW)	4.1	4.3	4.5	4.8	5.0	5.4
BLANKET - MAST CLEARANCE (IN)	12.8	12.7	12.6	12.5	12.5	12.3
* BOOM PROPERTIES *						
DIAMETER (IN)	5.48	7.32	8.75	9.99	11.09	12.78
EI (LB=IN=SQ)	.25170+06	.77471+06	.15814+07	.26826+07	.40881+07	.69693+07
ROOT SPRING (LB=IN/RAD)	.8192+04	.1904+05	.3251+05	.4832+05	.6628+05	.9888+05
BUCKLING CAPABILITY RATIO	40.18	23.88	17.06	13.33	10.97	8.74
STRENGTH CAPABILITY RATIO	.79	1.79	2.94	4.20	5.55	8.03
* CANNISTER PROPERTIES *						
HEIGHT (IN)	29.17	31.31	33.32	35.05	36.61	38.45
DIAMETER (IN)	6.47	8.64	10.32	11.78	13.09	15.08
* WEIGHTS (LB) *						
ARRAY	135.6	142.7	150.0	157.6	165.4	178.2
BOOM	4.0	7.0	10.1	13.3	16.5	21.5
CANNISTER	4.5	8.0	11.4	14.9	18.3	24.3
TENSION MECHANISM	1.2	1.3	1.6	2.2	2.7	3.7
MAST SLEEVE	2.4	2.9	3.2	3.6	3.9	4.4
SHAFT	1.0	1.0	1.1	1.1	1.2	1.4
HEADER	2.2	2.3	2.3	2.3	2.3	2.4
DRUM BEARING	1.5	1.5	1.6	1.6	1.7	1.8
CENTER SUPPORT	5.5	5.5	5.6	5.6	5.7	5.9
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.6	7.6	7.6	7.6	7.6	7.6
LEADING EDGE MEMBERS	1.9	1.9	1.9	1.9	1.9	1.8
DRUMS	11.0	10.9	10.7	10.7	10.6	10.5
LATCHES	.1	.1	.1	.1	.1	.1

ARRAY TYPE GE ROLLOUT POWER/WING = 15.0 KW ARRAY WIDTH = 4.50 M

BLANKET AREA = .16667+06 IN=SQ BLANKET WEIGHT = 91.5 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.015	.026	.037	.047	.057	.073
***** TORSIONAL FREQUENCY HZ *****	.015	.026	.037	.047	.057	.073
***** BENDING FREQUENCY HZ *****	.030	.052	.074	.095	.116	.149
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	73.2	72.5	71.9	71.4	71.0	70.3
ARRAY LENGTH (M)	28.90	29.19	29.43	29.64	29.82	30.09
ASPECT RATIO	6.42	6.49	6.54	6.59	6.63	6.69
ARRAY MASS (KG)	62.4	64.9	67.5	70.3	73.1	77.8
ARRAY WEIGHT (LB)	137.3	142.8	148.6	154.7	160.8	171.1
CENTER OF GRAVITY (IN)	440.0	438.1	435.0	431.0	427.2	419.7
TENSION PER BLANKET (LB)	.50	1.50	3.00	5.00	7.50	12.50
MOMENT OF INERTIA I1	.4793+08	.5014+08	.5220+08	.5422+08	.5623+08	.5932+08
MOMENT OF INERTIA I2	.2578+06	.2524+06	.2482+06	.2448+06	.2417+06	.2376+06
SPECIFIC POWER (KW/KG)	.240	.231	.222	.213	.205	.193
SPECIFIC WEIGHT (KG/KW)	4.2	4.3	4.5	4.7	4.9	5.2
BLANKET - MAST CLEARANCE (IN)	12.9	12.8	12.7	12.7	12.6	12.5
* BOOM PROPERTIES *						
DIAMETER (IN)	4.97	6.57	7.84	8.94	9.93	11.43
EI (LB-IN-SQ)	.18738+06	.57366+06	.11660+07	.19706+07	.29929+07	.50776+07
ROOT SPRING (LB-IN/RAD)	.6565+04	.1520+05	.2587+05	.3834+05	.5246+05	.7798+05
BUCKLING CAPABILITY RATIO	32.98	19.24	13.71	10.70	8.79	6.98
STRENGTH CAPABILITY RATIO	.68	1.52	2.50	3.59	4.76	6.95
* CANNISTER PROPERTIES *						
HEIGHT (IN)	26.66	28.94	30.76	32.33	33.74	35.35
DIAMETER (IN)	5.86	7.75	9.26	10.55	11.72	13.48
* WEIGHTS (LB) *						
ARRAY	137.3	142.8	148.6	154.7	160.8	171.1
BOOM	3.1	5.5	8.0	10.4	12.9	16.7
CANNISTER	3.7	6.5	9.2	12.0	14.8	19.6
TENSION MECHANISM	1.1	1.2	1.5	2.0	2.4	3.4
MAST SLEEVE	2.0	2.4	2.7	2.9	3.2	3.5
SHAFT	1.1	1.1	1.1	1.2	1.4	1.7
HEADER	2.6	2.6	2.6	2.7	2.7	2.9
DRUM BEARING	1.5	1.5	1.6	1.6	1.7	1.8
CENTER SUPPORT	6.5	6.5	6.4	6.4	6.4	6.4
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.6	7.6	7.6	7.6	7.6	7.6
LEADING EDGE MEMBERS	2.2	2.2	2.2	2.2	2.2	2.2
DRUMS	12.7	12.6	12.5	12.4	12.3	12.2
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 15.0 KW ARRAY WIDTH = 5.00 M

BLANKET AREA = .16667+06 IN=SQ BLANKET WEIGHT = 91.5 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.016	.028	.039	.050	.061	.078
***** TORSIONAL FREQUENCY HZ *****	.016	.028	.039	.050	.061	.078
***** BENDING FREQUENCY HZ *****	.032	.056	.079	.102	.124	.160
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	83.2	82.6	82.0	81.5	81.1	80.5
ARRAY LENGTH (M)	25.43	25.64	25.81	25.96	26.09	26.28
ASPECT RATIO	5.09	5.13	5.16	5.19	5.22	5.26
ARRAY MASS (KG)	63.0	65.1	67.2	69.4	71.8	75.7
ARRAY WEIGHT (LB)	138.5	143.1	147.8	152.8	158.0	166.6
CENTER OF GRAVITY (IN)	382.8	381.4	379.2	376.4	373.2	367.1
TENSION PER BLANKET (LB)	.50	1.50	3.00	5.00	7.50	12.50
MOMENT OF INERTIA I1	.3713+08	.3853+08	.3983+08	.4110+08	.4237+08	.4432+08
MOMENT OF INERTIA I2	.3391+06	.3332+06	.3287+06	.3249+06	.3216+06	.3172+06
SPECIFIC POWER (KW/KG)	.238	.231	.223	.216	.209	.198
SPECIFIC WEIGHT (KG/KW)	4.2	4.3	4.5	4.6	4.8	5.0
BLANKET - MAST CLEARANCE (IN)	12.9	12.9	12.8	12.8	12.8	12.7
* BOOM PROPERTIES *						
DIAMETER (IN)	4.54	6.00	7.16	8.16	9.05	10.41
EI (LB-IN-SQ)	.14506+06	.44248+06	.89673+06	.15116+07	.22907+07	.38734+07
ROOT SPRING (LB-IN/RAD)	.5419+04	.1251+05	.2124+05	.3143+05	.4292+05	.6365+05
BUCKLING CAPABILITY RATIO	27.57	16.05	11.43	8.90	7.30	5.80
STRENGTH CAPABILITY RATIO	.59	1.32	2.19	3.16	4.21	6.17
* CANNISTER PROPERTIES *						
HEIGHT (IN)	24.85	26.98	28.67	30.12	31.43	32.87
DIAMETER (IN)	5.36	7.08	8.45	9.63	10.68	12.29
* WEIGHTS (LB) *						
ARRAY	138.5	143.1	147.8	152.8	158.0	166.6
BOOM	2.6	4.5	6.4	8.4	10.4	13.4
CANNISTER	3.1	5.5	7.8	10.1	12.4	16.4
TENSION MECHANISM	1.1	1.2	1.4	1.9	2.3	3.1
MAST SLEEVE	1.7	2.0	2.3	2.5	2.7	3.0
SHAFT	1.4	1.4	1.4	1.4	1.6	2.0
HEADER	2.6	2.6	2.7	2.7	2.8	3.0
DRUM BEARING	1.5	1.5	1.6	1.6	1.7	1.8
CENTER SUPPORT	6.9	6.9	6.9	6.8	6.8	6.8
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.6	7.6	7.6	7.6	7.6	7.6
LEADING EDGE MEMBERS	2.5	2.5	2.5	2.5	2.5	2.5
DRUMS	14.4	14.3	14.2	14.1	14.0	13.9
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 15.0 KW   ARRAY WIDTH = 5.50 M

BLANKET AREA = .16667+06 IN-SQ   BLANKET WEIGHT = 91.5 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.017	.030	.042	.053	.065	.083
***** TORSIONAL FREQUENCY HZ *****	.017	.030	.042	.053	.065	.083
***** BENDING FREQUENCY HZ *****	.034	.059	.084	.108	.132	.169
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	93.2	92.6	92.1	91.6	91.2	90.7
ARRAY LENGTH (M)	22.71	22.86	22.99	23.10	23.20	23.34
ASPECT RATIO	4.13	4.16	4.18	4.20	4.22	4.24
ARRAY MASS (KG)	63.8	65.5	67.3	69.3	71.3	74.7
ARRAY WEIGHT (LB)	140.3	144.2	148.2	152.4	156.8	164.4
CENTER OF GRAVITY (IN)	337.5	336.4	334.8	332.6	330.2	325.4
TENSION PER BLANKET (LB)	.50	1.50	3.00	5.00	7.50	12.50
MOMENT OF INERTIA I1	.2968+08	.3061+08	.3149+08	.3234+08	.3319+08	.3455+08
MOMENT OF INERTIA I2	.4329+06	.4266+06	.4217+06	.4177+06	.4142+06	.4095+06
SPECIFIC POWER (KW/KG)	.235	.229	.223	.217	.211	.201
SPECIFIC WEIGHT (KG/KW)	4.3	4.4	4.5	4.6	4.8	5.0
BLANKET - MAST CLEARANCE (IN)	12.9	12.9	12.9	12.9	12.8	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	4.22	5.57	6.64	7.56	8.39	9.56
EI (LB-IN-SQ)	.11566+06	.35185+06	.71150+06	.11971+07	.18110+07	.30549+07
ROOT SPRING (LB-IN/RAD)	.4572+04	.1053+05	.1786+05	.2638+05	.3599+05	.5327+05
BUCKLING CAPABILITY RATIO	23.78	13.83	9.83	7.65	6.27	4.89
STRENGTH CAPABILITY RATIO	.53	1.19	1.98	2.86	3.81	5.46
* CANNISTER PROPERTIES *						
HEIGHT (IN)	23.19	25.19	26.79	28.16	29.38	31.12
DIAMETER (IN)	4.98	6.57	7.84	8.93	9.90	11.28
* WEIGHTS (LB) *						
ARRAY	140.3	144.2	148.2	152.4	156.8	164.4
BOOM	2.1	3.7	5.3	6.9	8.5	11.1
CANNISTER	2.7	4.7	6.7	8.7	10.7	13.9
TENSION MECHANISM	1.0	1.2	1.4	1.8	2.2	2.9
MAST SLEEVE	1.5	1.8	2.0	2.1	2.3	2.5
SHAFT	1.8	1.8	1.7	1.7	1.9	2.5
HEADER	2.6	2.6	2.7	2.8	2.9	3.1
DRUM BEARING	1.5	1.5	1.6	1.6	1.7	1.8
CENTER SUPPORT	7.4	7.3	7.3	7.3	7.3	7.3
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.6	7.6	7.6	7.6	7.6	7.6
LEADING EDGE MEMBERS	2.9	2.8	2.8	2.8	2.8	2.8
DRUMS	16.1	16.0	15.9	15.8	15.7	15.7
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 15.0 KW ARRAY WIDTH = 6.00 M

BLANKET AREA = .16667+06 IN=SQ BLANKET WEIGHT = 91.5 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.018	.031	.044	.056	.068	.087
***** TORSIONAL FREQUENCY HZ *****	.018	.031	.044	.056	.068	.087
***** BENDING FREQUENCY HZ *****	.036	.062	.088	.113	.139	.179
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	103.2	102.6	102.1	101.7	101.3	100.8
ARRAY LENGTH (M)	20.52	20.64	20.74	20.82	20.90	21.00
ASPECT RATIO	3.42	3.44	3.46	3.47	3.48	3.50
ARRAY MASS (KG)	64.7	66.3	67.8	69.5	71.2	74.4
ARRAY WEIGHT (LB)	142.4	145.8	149.2	152.9	156.7	163.7
CENTER OF GRAVITY (IN)	300.8	300.1	298.8	297.2	295.4	290.8
TENSION PER BLANKET (LB)	.50	1.50	3.00	5.00	7.50	12.50
MOMENT OF INERTIA I1	.2433+08	.2499+08	.2561+08	.2621+08	.2682+08	.2777+08
MOMENT OF INERTIA I2	.5396+06	.5328+06	.5276+06	.5233+06	.5196+06	.5147+06
SPECIFIC POWER (KW/KG)	.232	.226	.221	.216	.211	.202
SPECIFIC WEIGHT (KG/KW)	4.3	4.4	4.5	4.6	4.7	5.0
BLANKET - MAST CLEARANCE (IN)	13.0	13.0	12.9	12.9	12.9	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	3.94	5.20	6.20	7.06	7.82	8.99
EI (LB-IN-SQ)	.94435+05	.28670+06	.57885+06	.97261+06	.14695+07	.24746+07
ROOT SPRING (LB-IN/RAD)	.3927+04	.9032+04	.1530+05	.2258+05	.3077+05	.4548+05
BUCKLING CAPABILITY RATIO	20.74	12.05	8.56	6.66	5.45	4.32
STRENGTH CAPABILITY RATIO	.48	1.07	1.78	2.59	3.46	5.11
* CANNISTER PROPERTIES *						
HEIGHT (IN)	21.91	23.83	25.36	26.67	27.84	29.06
DIAMETER (IN)	4.65	6.13	7.31	8.33	9.23	10.61
* WEIGHTS (LB) *						
ARRAY	142.4	145.8	149.2	152.9	156.7	163.7
BOOM	1.8	3.1	4.5	5.8	7.2	9.2
CANNISTER	2.4	4.2	5.9	7.7	9.4	12.4
TENSION MECHANISM	1.0	1.1	1.3	1.7	2.1	2.8
MAST SLEEVE	1.4	1.6	1.7	1.9	2.0	2.2
SHAFT	2.2	2.2	2.2	2.1	2.2	3.1
HEADER	2.6	2.6	2.7	2.8	3.0	3.2
DRUM BEARING	1.5	1.5	1.6	1.6	1.7	1.8
CENTER SUPPORT	7.9	7.9	7.8	7.8	7.8	7.8
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	7.6	7.6	7.6	7.6	7.6	7.6
LEADING EDGE MEMBERS	3.2	3.1	3.1	3.1	3.1	3.1
DRUMS	17.8	17.7	17.6	17.5	17.5	17.4
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 20.0 KW   ARRAY WIDTH = 4.00 M

BLANKET AREA = .22222+06 IN-SQ   BLANKET WEIGHT = 122.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.024	.031	.039	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.011	.024	.031	.039	.046	.054
***** BENDING FREQUENCY HZ *****	.021	.047	.062	.080	.094	.112
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	62.6	61.1	60.4	59.6	59.1	57.3
ARRAY LENGTH (M)	45.06	46.20	46.76	47.34	47.77	49.28
ASPECT RATIO	11.27	11.55	11.69	11.83	11.94	12.32
ARRAY MASS (KG)	78.5	87.0	92.7	99.4	105.1	114.4
ARRAY WEIGHT (LB)	172.6	191.4	204.0	218.7	231.1	251.8
CENTER OF GRAVITY (IN)	719.4	708.9	700.1	690.9	681.5	681.0
TENSION PER BLANKET (LB)	.50	2.50	4.50	7.50	10.50	15.50
MOMENT OF INERTIA I1	.1514+09	.1695+09	.1805+09	.1933+09	.2034+09	.2283+09
MOMENT OF INERTIA I2	.2380+06	.2261+06	.2206+06	.2152+06	.2114+06	.1985+06
SPECIFIC POWER (KW/KG)	.255	.230	.216	.201	.190	.175
SPECIFIC WEIGHT (KG/KW)	3.9	4.4	4.6	5.0	5.3	5.7
BLANKET - MAST CLEARANCE (IN)	12.7	12.4	12.3	12.2	12.0	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	6.83	10.42	12.14	13.88	15.28	17.23
EI (LB-IN-SQ)	.45558+06	.23943+07	.44156+07	.75416+07	.10751+08	.16889+08
ROOT SPRING (LB-IN/RAD)	.1278+05	.4437+05	.7022+05	.1049+06	.1369+06	.1921+06
BUCKLING CAPABILITY RATIO	62.32	29.01	21.89	17.16	14.86	12.81
STRENGTH CAPABILITY RATIO	.86	2.78	4.19	5.91	7.57	9.98
* CANNISTER PROPERTIES *						
HEIGHT (IN)	33.98	38.34	40.66	43.01	44.36	46.93
DIAMETER (IN)	8.06	12.29	14.32	16.37	18.03	20.33
* WEIGHTS (LB) *						
ARRAY	172.6	191.4	204.0	218.7	231.1	251.8
BOOM	6.3	14.6	20.0	26.5	31.4	40.0
CANNISTER	6.9	16.0	21.7	28.3	34.3	43.6
TENSION MECHANISM	1.3	1.8	2.5	3.2	4.0	5.8
MAST SLEEVE	3.5	4.7	5.3	6.0	6.5	7.3
SHAFT	1.0	1.0	1.1	1.2	1.3	1.4
HEADER	2.2	2.3	2.3	2.3	2.4	2.4
DRUM BEARING	1.5	1.5	1.6	1.7	1.8	1.9
CENTER SUPPORT	5.6	5.5	5.6	5.7	5.8	6.0
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.0	8.0	8.0	8.0	8.0	8.0
LEADING EDGE MEMBERS	1.9	1.9	1.8	1.8	1.8	1.8
DRUMS	11.0	10.7	10.6	10.5	10.4	10.1
LATCHES	.1	.1	.1	.1	.1	.1

ARRAY TYPE GE ROLLOUT   POWER/WING = 20.0 KW   ARRAY WIDTH = 4.50 M

BLANKET AREA = .22222+06 IN-SQ   BLANKET WEIGHT = 122.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.012	.026	.034	.043	.050	.060
***** TORSIONAL FREQUENCY HZ *****	.012	.026	.034	.043	.050	.060
***** BENDING FREQUENCY HZ *****	.023	.050	.067	.086	.102	.123
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	72.7	71.3	70.6	69.9	69.5	68.8
ARRAY LENGTH (M)	38.81	39.58	39.96	40.35	40.64	41.01
ASPECT RATIO	8.62	8.80	8.88	8.97	9.03	9.11
ARRAY MASS (KG)	78.9	85.6	90.1	95.3	99.7	106.2
ARRAY WEIGHT (LB)	173.5	188.4	198.2	209.6	219.3	233.5
CENTER OF GRAVITY (IN)	613.7	606.8	600.8	593.1	587.1	578.0
TENSION PER BLANKET (LB)	.50	2.50	4.50	7.50	10.50	15.50
MOMENT OF INERTIA I1	.1123+09	.1229+09	.1292+09	.1362+09	.1421+09	.1504+09
MOMENT OF INERTIA I2	.3258+06	.3128+06	.3068+06	.3009+06	.2967+06	.2915+06
SPECIFIC POWER (KW/KG)	.254	.234	.222	.210	.201	.188
SPECIFIC WEIGHT (KG/KW)	3.9	4.3	4.5	4.8	5.0	5.3
BLANKET - MAST CLEARANCE (IN)	12.8	12.6	12.6	12.4	12.4	12.2
* BOOM PROPERTIES *						
DIAMETER (IN)	6.09	9.28	10.80	12.42	13.56	15.02
EI (LB-IN-SQ)	.33793+06	.17576+07	.32246+07	.54787+07	.77798+07	.11695+08
ROOT SPRING (LB-IN/RAD)	.1022+05	.3519+05	.5547+05	.8255+05	.1074+06	.1458+06
BUCKLING CAPABILITY RATIO	49.65	23.01	17.31	13.76	11.71	9.72
STRENGTH CAPABILITY RATIO	.71	2.33	3.53	5.16	6.48	8.39
* CANNISTER PROPERTIES *						
HEIGHT (IN)	31.59	35.45	37.51	39.20	40.73	42.69
DIAMETER (IN)	7.19	10.95	12.74	14.66	16.00	17.72
* WEIGHTS (LB) *						
ARRAY	173.5	188.4	198.2	209.6	219.3	233.5
BOOM	5.0	11.5	15.8	20.5	24.6	30.4
CANNISTER	5.5	12.7	17.2	22.8	27.2	33.3
TENSION MECHANISM	1.2	1.7	2.3	2.9	3.6	5.1
MAST SLEEVE	2.8	3.8	4.3	4.8	5.1	5.6
SHAFT	1.4	1.3	1.3	1.4	1.5	1.8
HEADER	2.6	2.6	2.7	2.7	2.8	2.9
DRUM BEARING	1.5	1.5	1.6	1.7	1.8	1.9
CENTER SUPPORT	6.9	6.8	6.8	6.7	6.7	6.7
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.0	8.0	8.0	8.0	8.0	8.0
LEADING EDGE MEMBERS	2.2	2.2	2.2	2.1	2.1	2.1
DRUMS	12.7	12.5	12.3	12.2	12.1	12.0
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 20.0 KW   ARRAY WIDTH = 5.00 M

BLANKET AREA = .22222+06 IN-SQ   BLANKET WEIGHT = 122.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.012	.027	.036	.046	.054	.065
***** TORSIONAL FREQUENCY HZ *****	.012	.027	.036	.046	.054	.065
***** BENDING FREQUENCY HZ *****	.024	.054	.072	.093	.109	.132
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	82.8	81.5	80.8	80.2	79.7	79.2
ARRAY LENGTH (M)	34.10	34.65	34.91	35.19	35.39	35.65
ASPECT RATIO	6.82	6.93	6.98	7.04	7.08	7.13
ARRAY MASS (KG)	79.2	84.7	88.3	92.5	96.1	101.5
ARRAY WEIGHT (LB)	174.2	186.3	194.3	203.5	211.5	223.3
CENTER OF GRAVITY (IN)	534.3	529.5	524.3	519.2	514.5	506.8
TENSION PER BLANKET (LB)	.50	2.50	4.50	7.50	10.50	15.50
MOMENT OF INERTIA I1	.8640+08	.9305+08	.9686+08	.1013+09	.1049+09	.1100+09
MOMENT OF INERTIA I2	.4281+06	.4141+06	.4077+06	.4013+06	.3968+06	.3913+06
SPECIFIC POWER (KW/KG)	.253	.236	.226	.216	.208	.197
SPECIFIC WEIGHT (KG/KW)	4.0	4.2	4.4	4.6	4.8	5.1
BLANKET - MAST CLEARANCE (IN)	12.9	12.8	12.7	12.6	12.5	12.5
* BOOM PROPERTIES *						
DIAMETER (IN)	5.58	8.41	9.85	11.24	12.26	13.56
EI (LB-IN-SQ)	.26081+06	.13465+07	.24614+07	.41666+07	.59004+07	.88383+07
ROOT SPRING (LB-IN/RAD)	.8413+04	.2882+05	.4530+05	.6723+05	.8727+05	.1182+06
BUCKLING CAPABILITY RATIO	41.57	18.89	14.42	11.26	9.57	7.93
STRENGTH CAPABILITY RATIO	.62	2.01	3.14	4.49	5.66	7.37
* CANNISTER PROPERTIES *						
HEIGHT (IN)	29.25	33.13	34.63	36.51	37.90	39.67
DIAMETER (IN)	6.58	9.92	11.63	13.26	14.47	16.00
* WEIGHTS (LB) *						
ARRAY	174.2	186.3	194.3	203.5	211.5	223.3
BOOM	4.1	9.4	12.6	16.6	19.8	24.5
CANNISTER	4.6	10.5	14.4	18.8	22.4	27.4
TENSION MECHANISM	1.2	1.6	2.1	2.7	3.3	4.6
MAST SLEEVE	2.4	3.2	3.6	4.0	4.2	4.6
SHAFT	1.8	1.7	1.7	1.7	1.8	2.2
HEADER	2.6	2.6	2.7	2.8	2.9	3.1
DRUM BEARING	1.5	1.5	1.6	1.7	1.8	1.9
CENTER SUPPORT	7.4	7.3	7.3	7.2	7.2	7.2
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.0	8.0	8.0	8.0	8.0	8.0
LEADING EDGE MEMBERS	2.5	2.5	2.5	2.5	2.4	2.4
DRUMS	14.4	14.2	14.1	14.0	13.9	13.8
LATCHES	.3	.3	.3	.3	.3	.3

C-6

ORIGINAL PAGE IS
OF POOR QUALITY

ARRAY TYPE GE ROLLOUT　　POWER/WING = 20.0 KW　　ARRAY WIDTH = 5.50 M

BLANKET AREA = .22222+06 IN-SQ　　BLANKET WEIGHT = 122.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.013	.029	.039	.049	.058	.069
***** TORSIONAL FREQUENCY HZ *****	.013	.029	.039	.049	.058	.069
***** BENDING FREQUENCY HZ *****	.026	.057	.076	.098	.116	.141
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	92.8	91.5	91.0	90.4	89.9	89.4
ARRAY LENGTH (M)	30.42	30.83	31.03	31.23	31.38	31.57
ASPECT RATIO	5.53	5.60	5.64	5.68	5.70	5.74
ARRAY MASS (KG)	79.8	84.4	87.5	91.0	94.0	98.7
ARRAY WEIGHT (LB)	175.5	185.7	192.5	200.3	206.9	217.1
CENTER OF GRAVITY (IN)	471.7	468.2	464.7	460.3	456.7	450.0
TENSION PER BLANKET (LB)	.50	2.50	4.50	7.50	10.50	15.50
MOMENT OF INERTIA I1	.6874+08	.7316+08	.7576+08	.7861+08	.8101+08	.8438+08
MOMENT OF INERTIA I2	.5455+06	.5305+06	.5236+06	.5168+06	.5120+06	.5062+06
SPECIFIC POWER (KW/KG)	.251	.237	.229	.220	.213	.203
SPECIFIC WEIGHT (KG/KW)	4.0	4.2	4.4	4.6	4.7	4.9
BLANKET - MAST CLEARANCE (IN)	12.9	12.9	12.8	12.7	12.7	12.6
* BOOM PROPERTIES *						
DIAMETER (IN)	5.14	7.73	8.99	10.33	11.26	12.45
EI (LB-IN-SQ)	.20758+06	.10660+07	.19438+07	.32818+07	.46385+07	.69309+07
ROOT SPRING (LB-IN/RAD)	.7090+04	.2419+05	.3795+05	.5621+05	.7286+05	.9847+05
BUCKLING CAPABILITY RATIO	35.30	16.00	12.00	9.51	8.08	6.69
STRENGTH CAPABILITY RATIO	.55	1.78	2.71	4.00	5.06	6.61
* CANNISTER PROPERTIES *						
HEIGHT (IN)	27.51	31.12	32.87	34.23	35.51	37.15
DIAMETER (IN)	6.06	9.13	10.61	12.19	13.29	14.70
* WEIGHTS (LB) *						
ARRAY	175.5	185.7	192.5	200.3	206.9	217.1
BOOM	3.4	7.8	10.7	13.7	16.4	20.1
CANNISTER	4.0	9.0	12.1	16.0	19.0	23.2
TENSION MECHANISM	1.1	1.5	2.0	2.5	3.1	4.3
MAST SLEEVE	2.1	2.7	3.0	3.4	3.6	3.9
SHAFT	2.3	2.2	2.2	2.1	2.2	2.8
HEADER	2.6	2.7	2.7	2.9	3.0	3.2
DRUM BEARING	1.5	1.5	1.6	1.7	1.8	1.9
CENTER SUPPORT	8.0	7.9	7.9	7.8	7.8	7.8
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.0	8.0	8.0	8.0	8.0	8.0
LEADING EDGE MEMBERS	2.8	2.8	2.8	2.8	2.8	2.7
DRUMS	16.1	15.9	15.8	15.7	15.6	15.5
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 20.0 KW ARRAY WIDTH = 6.00 M

BLANKET AREA = .22222+06 IN=SQ BLANKET WEIGHT = 122.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.014	.031	.041	.052	.061	.073
***** TORSIONAL FREQUENCY HZ *****	.014	.031	.041	.052	.061	.073
***** BENDING FREQUENCY HZ *****	.027	.060	.080	.104	.122	.148
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	102.8	101.6	101.1	100.5	100.1	99.6
ARRAY LENGTH (M)	27.46	27.77	27.93	28.08	28.19	28.34
ASPECT RATIO	4.58	4.63	4.65	4.68	4.70	4.72
ARRAY MASS (KG)	80.7	84.6	87.3	90.3	92.9	97.1
ARRAY WEIGHT (LB)	177.5	186.2	192.0	198.7	204.4	213.6
CENTER OF GRAVITY (IN)	420.8	418.1	415.4	412.5	409.7	404.0
TENSION PER BLANKET (LB)	.50	2.50	4.50	7.50	10.50	15.50
MOMENT OF INERTIA I1	.5609+08	.5915+08	.6096+08	.6302+08	.6470+08	.6708+08
MOMENT OF INERTIA I2	.6786+06	.6627+06	.6554+06	.6482+06	.6431+06	.6372+06
SPECIFIC POWER (KW/KG)	.248	.236	.229	.221	.215	.206
SPECIFIC WEIGHT (KG/KW)	4.0	4.2	4.4	4.5	4.6	4.9
BLANKET - MAST CLEARANCE (IN)	12.9	12.9	12.9	12.8	12.8	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	4.80	7.22	8.39	9.55	10.41	11.51
EI (LB-IN-SQ)	.16919+06	.86539+06	.15748+07	.26536+07	.37451+07	.55855+07
ROOT SPRING (LB-IN/RAD)	.6082+04	.2068+05	.3241+05	.4793+05	.6206+05	.8376+05
BUCKLING CAPABILITY RATIO	30.81	13.94	10.45	8.14	6.90	5.71
STRENGTH CAPABILITY RATIO	.50	1.62	2.47	3.56	4.51	5.91
* CANNISTER PROPERTIES *						
HEIGHT (IN)	25.84	29.24	30.88	32.52	33.73	35.27
DIAMETER (IN)	5.66	8.52	9.89	11.27	12.29	13.58
* WEIGHTS (LB) *						
ARRAY	177.5	186.2	192.0	198.7	204.4	213.6
BOOM	2.9	6.6	8.9	11.7	13.9	17.1
CANNISTER	3.5	7.9	10.6	13.7	16.3	19.9
TENSION MECHANISM	1.1	1.4	1.9	2.4	2.9	4.0
MAST SLEEVE	1.9	2.4	2.7	2.9	3.1	3.4
SHAFT	2.8	2.7	2.7	2.7	2.7	3.5
HEADER	2.6	2.7	2.8	2.9	3.1	3.3
DRUM BEARING	1.5	1.5	1.6	1.7	1.8	1.9
CENTER SUPPORT	8.7	8.6	8.5	8.5	8.5	8.4
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.0	8.0	8.0	8.0	8.0	8.0
LEADING EDGE MEMBERS	3.1	3.1	3.1	3.1	3.1	3.0
DRUMS	17.8	17.6	17.5	17.4	17.3	17.3
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 20.0 KW ARRAY WIDTH = 6.50 M

BLANKET AREA = .22222+06 IN-SQ BLANKET WEIGHT = 122.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.014	.032	.043	.054	.064	.077
***** TORSIONAL FREQUENCY HZ *****	.014	.032	.043	.054	.064	.077
***** BENDING FREQUENCY HZ *****	.028	.063	.084	.109	.128	.156
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	112.7	111.6	111.1	110.6	110.2	109.7
ARRAY LENGTH (M)	25.03	25.28	25.40	25.52	25.61	25.72
ASPECT RATIO	3.85	3.89	3.91	3.93	3.94	3.96
ARRAY MASS (KG)	81.7	85.2	87.5	90.2	92.4	96.3
ARRAY WEIGHT (LB)	179.8	187.4	192.5	198.4	203.4	211.9
CENTER OF GRAVITY (IN)	378.7	376.7	374.6	372.3	370.2	365.0
TENSION PER BLANKET (LB)	.50	2.50	4.50	7.50	10.50	15.50
MOMENT OF INERTIA I1	.4672+08	.4893+08	.5024+08	.5175+08	.5299+08	.5474+08
MOMENT OF INERTIA I2	.8279+06	.8112+06	.8035+06	.7960+06	.7907+06	.7847+06
SPECIFIC POWER (KW/KG)	.245	.235	.229	.222	.216	.208
SPECIFIC WEIGHT (KG/KW)	4.1	4.3	4.4	4.5	4.6	4.8
BLANKET - MAST CLEARANCE (IN)	13.0	12.9	12.9	12.9	12.9	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	4.51	6.77	7.86	8.95	9.76	10.78
EI (LB-IN-SQ)	.14059+06	.71678+06	.13024+07	.21912+07	.30889+07	.46001+07
ROOT SPRING (LB-IN/RAD)	.5293+04	.1796+05	.2810+05	.4152+05	.5371+05	.7241+05
BUCKLING CAPABILITY RATIO	27.14	12.26	9.18	7.14	6.06	5.01
STRENGTH CAPABILITY RATIO	.45	1.47	2.25	3.25	4.12	5.41
* CANNISTER PROPERTIES *						
HEIGHT (IN)	24.51	27.75	29.31	30.87	32.02	33.48
DIAMETER (IN)	5.32	7.99	9.28	10.56	11.51	12.72
* WEIGHTS (LB) *						
ARRAY	179.8	187.4	192.5	198.4	203.4	211.9
BOOM	2.5	5.6	7.6	10.0	11.9	14.6
CANNISTER	3.1	6.9	9.4	12.1	14.4	17.6
TENSION MECHANISM	1.1	1.4	1.8	2.3	2.7	3.8
MAST SLEEVE	1.7	2.1	2.4	2.6	2.8	3.0
SHAFT	3.4	3.3	3.3	3.2	3.3	4.3
HEADER	2.6	2.7	2.8	3.0	3.2	3.5
DRUM BEARING	1.5	1.5	1.6	1.7	1.8	1.9
CENTER SUPPORT	9.4	9.3	9.3	9.2	9.2	9.2
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.0	8.0	8.0	8.0	8.0	8.0
LEADING EDGE MEMBERS	3.4	3.4	3.4	3.4	3.4	3.4
DRUMS	19.5	19.3	19.2	19.1	19.1	19.0
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 20.0 KW ARRAY WIDTH = 7.00 M

BLANKET AREA = .22222+06 IN-SQ BLANKET WEIGHT = 122.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.015	.033	.044	.057	.067	.080
***** TORSIONAL FREQUENCY HZ *****	.015	.033	.044	.057	.067	.080
***** BENDING FREQUENCY HZ *****	.030	.066	.088	.114	.134	.163
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	122.7	121.6	121.1	120.6	120.3	119.8
ARRAY LENGTH (M)	23.00	23.20	23.30	23.39	23.46	23.56
ASPECT RATIO	3.29	3.31	3.33	3.34	3.35	3.37
ARRAY MASS (KG)	82.9	86.0	88.1	90.4	92.5	96.2
ARRAY WEIGHT (LB)	182.5	189.2	193.8	199.0	203.5	211.6
CENTER OF GRAVITY (IN)	343.3	341.9	340.3	338.6	336.9	332.1
TENSION PER BLANKET (LB)	.50	2.50	4.50	7.50	10.50	15.50
MOMENT OF INERTIA I1	.3958+08	.4124+08	.4224+08	.4339+08	.4435+08	.4571+08
MOMENT OF INERTIA I2	.9937+06	.9760+06	.9680+06	.9601+06	.9547+06	.9485+06
SPECIFIC POWER (KW/KG)	.241	.233	.227	.221	.216	.208
SPECIFIC WEIGHT (KG/KW)	4.1	4.3	4.4	4.5	4.6	4.8
BLANKET - MAST CLEARANCE (IN)	13.0	13.0	13.0	12.9	12.9	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	4.24	6.37	7.40	8.42	9.18	10.14
EI (LB-IN-SQ)	.11872+06	.60388+06	.10960+07	.18417+07	.25941+07	.38589+07
ROOT SPRING (LB-IN/RAD)	.4663+04	.1579+05	.2469+05	.3645+05	.4712+05	.6347+05
BUCKLING CAPABILITY RATIO	24.09	10.87	8.13	6.33	5.36	4.43
STRENGTH CAPABILITY RATIO	.41	1.34	2.05	2.97	3.77	4.96
* CANNISTER PROPERTIES *						
HEIGHT (IN)	23.45	26.57	28.08	29.58	30.68	32.09
DIAMETER (IN)	5.01	7.52	8.73	9.94	10.83	11.96
* WEIGHTS (LB) *						
ARRAY	182.5	189.2	193.8	199.0	203.5	211.6
BOOM	2.2	4.9	6.7	8.7	10.3	12.6
CANNISTER	2.7	6.2	8.4	10.8	12.8	15.7
TENSION MECHANISM	1.0	1.3	1.8	2.2	2.6	3.6
MAST SLEEVE	1.5	1.9	2.1	2.3	2.5	2.7
SHAFT	4.0	4.0	3.9	3.9	4.0	5.3
HEADER	2.6	2.7	2.9	3.1	3.3	3.7
DRUM BEARING	1.5	1.5	1.6	1.7	1.8	1.9
CENTER SUPPORT	10.3	10.2	10.1	10.1	10.0	10.0
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.0	8.0	8.0	8.0	8.0	8.0
LEADING EDGE MEMBERS	3.8	3.7	3.7	3.7	3.7	3.7
DRUMS	21.2	21.0	20.9	20.8	20.8	20.7
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 25.0 KW ARRAY WIDTH = 5.00 M

BLANKET AREA = .27778+06 IN-SQ BLANKET WEIGHT = 152.5 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.017	.026	.035	.041	.050
***** TORSIONAL FREQUENCY HZ *****	.010	.017	.026	.035	.041	.050
***** BENDING FREQUENCY HZ *****	.019	.033	.051	.069	.083	.102
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	82.3	81.3	80.4	79.5	78.9	78.2
ARRAY LENGTH (M)	42.86	43.38	43.90	44.36	44.70	45.11
ASPECT RATIO	8.57	8.68	8.78	8.87	8.94	9.02
ARRAY MASS (KG)	95.6	100.1	106.1	112.6	117.9	125.3
ARRAY WEIGHT (LB)	210.3	220.3	233.4	247.6	259.4	275.8
CENTER OF GRAVITY (IN)	688.6	680.7	677.9	670.1	661.9	652.8
TENSION PER BLANKET (LB)	.50	1.50	3.50	6.50	9.50	14.50
MOMENT OF INERTIA I1	.1679+09	.1769+09	.1878+09	.1991+09	.2076+09	.2198+09
MOMENT OF INERTIA I2	.5152+06	.5025+06	.4904+06	.4800+06	.4730+06	.4645+06
SPECIFIC POWER (KW/KG)	.261	.250	.236	.222	.212	.199
SPECIFIC WEIGHT (KG/KW)	3.8	4.0	4.2	4.5	4.7	5.0
BLANKET - MAST CLEARANCE (IN)	12.8	12.7	12.6	12.5	12.4	12.3
* BOOM PROPERTIES *						
DIAMETER (IN)	6.56	8.75	10.88	12.76	14.20	15.85
EI (LB-IN-SQ)	.41209+06	.12663+07	.30263+07	.57406+07	.85155+07	.13239+08
ROOT SPRING (LB-IN/RAD)	.1186+05	.2752+05	.5289+05	.8550+05	.1149+06	.1600+06
BUCKLING CAPABILITY RATIO	57.47	34.11	22.60	16.76	14.18	11.58
STRENGTH CAPABILITY RATIO	.65	1.48	2.72	4.19	5.57	7.40
* CANNISTER PROPERTIES *						
HEIGHT (IN)	33.27	35.70	38.51	41.00	42.37	44.54
DIAMETER (IN)	7.74	10.32	12.83	15.06	16.75	18.70
* WEIGHTS (LB) *						
ARRAY	210.3	220.3	233.4	247.6	259.4	275.8
BOOM	5.9	10.3	16.0	22.3	27.0	33.9
CANNISTER	6.3	11.3	17.4	24.0	29.7	37.0
TENSION MECHANISM	1.3	1.5	2.1	2.9	3.8	5.2
MAST SLEEVE	3.2	3.9	4.7	5.3	5.8	6.4
SHAFT	2.2	2.1	2.1	2.0	2.0	2.1
HEADER	2.6	2.6	2.7	2.8	2.9	3.0
DRUM BEARING	1.5	1.5	1.6	1.7	1.7	1.9
CENTER SUPPORT	7.9	7.8	7.7	7.7	7.6	7.6
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.5	8.5	8.5	8.5	8.5	8.5
LEADING EDGE MEMBERS	2.5	2.5	2.5	2.4	2.4	2.4
DRUMS	14.4	14.3	14.1	13.9	13.8	13.7
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 25.0 KW ARRAY WIDTH = 5.50 M

BLANKET AREA = .27778+06 IN-SQ BLANKET WEIGHT = 152.5 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.018	.027	.037	.044	.054
***** TORSIONAL FREQUENCY HZ *****	.011	.018	.027	.037	.044	.054
***** BENDING FREQUENCY HZ *****	.021	.035	.054	.073	.088	.108
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	92.3	91.4	90.5	89.7	89.2	88.5
ARRAY LENGTH (M)	38.20	38.59	38.97	39.32	39.56	39.87
ASPECT RATIO	6.95	7.02	7.09	7.15	7.19	7.25
ARRAY MASS (KG)	96.0	99.8	104.8	110.2	114.6	120.8
ARRAY WEIGHT (LB)	211.3	219.6	230.5	242.4	252.2	265.9
CENTER OF GRAVITY (IN)	608.4	605.9	600.2	594.0	588.5	581.3
TENSION PER BLANKET (LB)	.50	1.50	3.50	6.50	9.50	14.50
MOMENT OF INERTIA I1	.1330+09	.1391+09	.1461+09	.1534+09	.1592+09	.1672+09
MOMENT OF INERTIA I2	.6559+06	.6424+06	.6294+06	.6183+06	.6108+06	.6018+06
SPECIFIC POWER (KW/KG)	.260	.250	.239	.227	.218	.207
SPECIFIC WEIGHT (KG/KW)	3.8	4.0	4.2	4.4	4.6	4.8
BLANKET - MAST CLEARANCE (IN)	12.9	12.8	12.7	12.7	12.6	12.6
* BOOM PROPERTIES *						
DIAMETER (IN)	6.05	8.00	10.01	11.74	12.95	14.45
EI (LB-IN-SQ)	.32740+06	.10021+07	.23854+07	.45089+07	.66717+07	.10340+08
ROOT SPRING (LB-IN/RAD)	.9978+04	.2309+05	.4425+05	.7133+05	.9570+05	.1329+06
BUCKLING CAPABILITY RATIO	48.87	28.50	19.15	14.17	11.80	9.62
STRENGTH CAPABILITY RATIO	.58	1.29	2.43	3.76	4.89	6.52
* CANNISTER PROPERTIES *						
HEIGHT (IN)	31.15	33.76	35.96	38.25	39.85	41.83
DIAMETER (IN)	7.13	9.44	11.81	13.85	15.28	17.05
* WEIGHTS (LB) *						
ARRAY	211.3	219.6	230.5	242.4	252.2	265.9
BOOM	4.9	8.6	13.2	18.4	22.5	28.2
CANNISTER	5.4	9.5	14.8	20.4	24.8	30.9
TENSION MECHANISM	1.2	1.4	1.9	2.7	3.5	4.7
MAST SLEEVE	2.8	3.4	4.0	4.5	4.8	5.3
SHAFT	2.7	2.7	2.6	2.6	2.5	2.6
HEADER	2.6	2.6	2.7	2.8	2.9	3.1
DRUM BEARING	1.5	1.5	1.6	1.7	1.7	1.9
CENTER SUPPORT	8.6	8.5	8.4	8.4	8.3	8.3
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.5	8.5	8.5	8.5	8.5	8.5
LEADING EDGE MEMBERS	2.8	2.8	2.8	2.7	2.7	2.7
DRUMS	16.1	16.0	15.8	15.7	15.6	15.5
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 25.0 KW ARRAY WIDTH = 6.00 M

BLANKET AREA = .27778+06 IN-SQ BLANKET WEIGHT = 152.5 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.019	.029	.039	.047	.057
***** TORSIONAL FREQUENCY HZ *****	.011	.019	.029	.039	.047	.057
***** BENDING FREQUENCY HZ *****	.022	.037	.057	.077	.093	.114
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	102.4	101.5	100.7	99.9	99.4	98.8
ARRAY LENGTH (M)	34.46	34.75	35.04	35.30	35.49	35.71
ASPECT RATIO	5.74	5.79	5.84	5.88	5.91	5.95
ARRAY MASS (KG)	96.8	100.0	104.2	108.9	112.7	118.0
ARRAY WEIGHT (LB)	212.9	220.0	229.3	239.5	247.9	259.6
CENTER OF GRAVITY (IN)	543.2	541.4	537.0	532.1	527.8	521.9
TENSION PER BLANKET (LB)	.50	1.50	3.50	6.50	9.50	14.50
MOMENT OF INERTIA I1	.1081+09	.1123+09	.1172+09	.1222+09	.1262+09	.1316+09
MOMENT OF INERTIA I2	.8155+06	.8013+06	.7876+06	.7760+06	.7681+06	.7587+06
SPECIFIC POWER (KW/KG)	.258	.250	.240	.230	.222	.212
SPECIFIC WEIGHT (KG/KW)	3.9	4.0	4.2	4.4	4.5	4.7
BLANKET - MAST CLEARANCE (IN)	12.9	12.9	12.8	12.7	12.7	12.7
* BOOM PROPERTIES *						
DIAMETER (IN)	5.61	7.41	9.27	10.86	11.97	13.35
EI (LB-IN-SQ)	.26637+06	.81276+06	.19285+07	.36349+07	.53678+07	.82987+07
ROOT SPRING (LB-IN/RAD)	.8548+04	.1973+05	.3773+05	.6069+05	.8130+05	.1127+06
BUCKLING CAPABILITY RATIO	42.01	24.46	16.41	12.13	10.09	8.22
STRENGTH CAPABILITY RATIO	.51	1.14	2.16	3.36	4.39	5.87
* CANNISTER PROPERTIES *						
HEIGHT (IN)	29.53	31.96	33.99	36.12	37.60	39.45
DIAMETER (IN)	6.61	8.74	10.94	12.82	14.13	15.75
* WEIGHTS (LB) *						
ARRAY	212.9	220.0	229.3	239.5	247.9	259.6
BOOM	4.2	7.4	11.2	15.5	19.0	23.8
CANNISTER	4.7	8.2	12.8	17.5	21.3	26.5
TENSION MECHANISM	1.2	1.3	1.8	2.5	3.3	4.4
MAST SLEEVE	2.5	2.9	3.4	3.9	4.2	4.6
SHAFT	3.4	3.3	3.3	3.2	3.2	3.2
HEADER	2.6	2.6	2.7	2.9	3.0	3.3
DRUM BEARING	1.5	1.5	1.6	1.7	1.7	1.9
CENTER SUPPORT	9.4	9.3	9.3	9.2	9.1	9.1
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.5	8.5	8.5	8.5	8.5	8.5
LEADING EDGE MEMBERS	3.1	3.1	3.1	3.1	3.0	3.0
DRUMS	17.8	17.7	17.5	17.4	17.3	17.2
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 25.0 KW ARRAY WIDTH = 6.50 M

BLANKET AREA = .27778+06 IN-SQ BLANKET WEIGHT = 152.5 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.012	.020	.030	.041	.049	.060
***** TORSIONAL FREQUENCY HZ *****	.012	.020	.030	.041	.049	.060
***** BENDING FREQUENCY HZ *****	.023	.039	.059	.081	.097	.120
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	112.4	111.6	110.8	110.1	109.6	109.0
ARRAY LENGTH (M)	31.39	31.62	31.85	32.05	32.20	32.37
ASPECT RATIO	4.83	4.86	4.90	4.93	4.95	4.98
ARRAY MASS (KG)	97.8	100.6	104.3	108.3	111.6	116.3
ARRAY WEIGHT (LB)	215.1	221.2	229.4	238.2	245.5	255.9
CENTER OF GRAVITY (IN)	489.2	487.8	484.8	481.1	477.7	472.1
TENSION PER BLANKET (LB)	.50	1.50	3.50	6.50	9.50	14.50
MOMENT OF INERTIA I1	.8981+08	.9280+08	.9634+08	.1000+09	.1029+09	.1067+09
MOMENT OF INERTIA I2	.9937+06	.9787+06	.9644+06	.9521+06	.9439+06	.9341+06
SPECIFIC POWER (KW/KG)	.256	.249	.240	.231	.224	.215
SPECIFIC WEIGHT (KG/KW)	3.9	4.0	4.2	4.3	4.5	4.7
BLANKET - MAST CLEARANCE (IN)	12.9	12.9	12.9	12.8	12.8	12.7
* BOOM PROPERTIES *						
DIAMETER (IN)	5.26	6.95	8.62	10.10	11.13	12.51
EI (LB-IN-SQ)	.22111+06	.67305+06	.15932+07	.29967+07	.44189+07	.68191+07
ROOT SPRING (LB-IN/RAD)	.7433+04	.1713+05	.3269+05	.5251+05	.7026+05	.9728+05
BUCKLING CAPABILITY RATIO	37.04	21.54	14.20	10.49	8.72	7.21
STRENGTH CAPABILITY RATIO	.46	1.04	1.93	3.01	3.93	5.41
* CANNISTER PROPERTIES *						
HEIGHT (IN)	27.91	30.21	32.48	34.49	35.90	37.24
DIAMETER (IN)	6.21	8.20	10.18	11.92	13.13	14.76
* WEIGHTS (LB) *						
ARRAY	215.1	221.2	229.4	238.2	245.5	255.9
BOOM	3.6	6.3	9.7	13.5	16.4	20.2
CANNISTER	4.1	7.2	11.1	15.3	18.5	23.3
TENSION MECHANISM	1.1	1.3	1.7	2.4	3.1	4.1
MAST SLEEVE	2.2	2.6	3.0	3.4	3.7	4.0
SHAFT	4.1	4.0	4.0	3.9	3.9	4.0
HEADER	2.6	2.6	2.8	3.0	3.1	3.4
DRUM BEARING	1.5	1.5	1.6	1.7	1.7	1.9
CENTER SUPPORT	10.3	10.2	10.2	10.1	10.0	10.0
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.5	8.5	8.5	8.5	8.5	8.5
LEADING EDGE MEMBERS	3.4	3.4	3.4	3.4	3.4	3.3
DRUMS	19.5	19.4	19.2	19.1	19.0	18.9
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 25.0 KW   ARRAY WIDTH = 7.00 M

BLANKET AREA = .27778+06 IN-SQ   BLANKET WEIGHT = 152.5 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.012	.021	.032	.043	.051	.063
***** TORSIONAL FREQUENCY HZ *****	.012	.021	.032	.043	.051	.063
***** BENDING FREQUENCY HZ *****	.024	.041	.062	.084	.102	.126
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	122.4	121.6	120.8	120.2	119.7	119.1
ARRAY LENGTH (M)	28.83	29.02	29.20	29.36	29.47	29.61
ASPECT RATIO	4.12	4.15	4.17	4.19	4.21	4.23
ARRAY MASS (KG)	99.0	101.4	104.7	108.2	111.2	115.5
ARRAY WEIGHT (LB)	217.7	223.1	230.3	238.1	244.6	254.0
CENTER OF GRAVITY (IN)	443.7	442.7	440.4	437.5	434.9	430.8
TENSION PER BLANKET (LB)	.50	1.50	3.50	6.50	9.50	14.50
MOMENT OF INERTIA I1	.7587+08	.7809+08	.8072+08	.8345+08	.8562+08	.8862+08
MOMENT OF INERTIA I2	.1191+07	.1176+07	.1161+07	.1148+07	.1139+07	.1129+07
SPECIFIC POWER (KW/KG)	.253	.246	.239	.231	.225	.217
SPECIFIC WEIGHT (KG/KW)	4.0	4.1	4.2	4.3	4.4	4.6
BLANKET - MAST CLEARANCE (IN)	13.0	12.9	12.9	12.9	12.9	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	4.96	6.55	8.12	9.51	10.47	11.67
EI (LB-IN-SQ)	.18652+06	.56668+06	.13389+07	.25141+07	.37029+07	.57059+07
ROOT SPRING (LB-IN/RAD)	.6543+04	.1506+05	.2869+05	.4603+05	.6154+05	.8511+05
BUCKLING CAPABILITY RATIO	32.90	19.12	12.59	9.29	7.72	6.28
STRENGTH CAPABILITY RATIO	.42	.95	1.77	2.76	3.61	4.85
* CANNISTER PROPERTIES *						
HEIGHT (IN)	26.60	28.79	30.96	32.87	34.20	35.85
DIAMETER (IN)	5.85	7.73	9.58	11.22	12.36	13.77
* WEIGHTS (LB) *						
ARRAY	217.7	223.1	230.3	238.1	244.6	254.0
BOOM	3.1	5.5	8.5	11.7	14.2	17.7
CANNISTER	3.7	6.4	9.9	13.6	16.5	20.5
TENSION MECHANISM	1.1	1.2	1.7	2.3	3.0	3.9
MAST SLEEVE	2.0	2.3	2.7	3.0	3.3	3.5
SHAFT	4.9	4.8	4.7	4.7	4.6	5.0
HEADER	2.6	2.7	2.8	3.0	3.3	3.6
DRUM BEARING	1.5	1.5	1.6	1.7	1.7	1.9
CENTER SUPPORT	11.3	11.2	11.2	11.1	11.0	11.0
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.5	8.5	8.5	8.5	8.5	8.5
LEADING EDGE MEMBERS	3.7	3.7	3.7	3.7	3.7	3.6
DRUMS	21.2	21.1	20.9	20.8	20.8	20.7
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 25.0 KW ARRAY WIDTH = 7.50 M

BLANKET AREA = .27778+06 IN-SQ BLANKET WEIGHT = 152.5 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.013	.022	.033	.045	.053	.065
***** TORSIONAL FREQUENCY HZ *****	.013	.022	.033	.045	.053	.065
***** BENDING FREQUENCY HZ *****	.025	.042	.065	.088	.106	.131
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	132.9	131.6	130.8	130.2	129.8	129.2
ARRAY LENGTH (M)	26.55	26.82	26.96	27.10	27.19	27.30
ASPECT RATIO	3.54	3.58	3.60	3.61	3.63	3.64
ARRAY MASS (KG)	100.4	102.5	105.4	108.6	111.3	115.3
ARRAY WEIGHT (LB)	221.0	225.6	232.0	239.0	244.9	253.6
CENTER OF GRAVITY (IN)	402.9	404.3	402.6	400.4	398.3	394.7
TENSION PER BLANKET (LB)	.50	1.50	3.50	6.50	9.50	14.50
MOMENT OF INERTIA I1	.6449+08	.6674+08	.6877+08	.7089+08	.7258+08	.7495+08
MOMENT OF INERTIA I2	.1422+07	.1392+07	.1376+07	.1363+07	.1354+07	.1344+07
SPECIFIC POWER (KW/KG)	.249	.244	.237	.230	.225	.217
SPECIFIC WEIGHT (KG/KW)	4.0	4.1	4.2	4.3	4.5	4.6
BLANKET - MAST CLEARANCE (IN)	12.4	13.0	13.0	13.0	12.9	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	4.68	6.19	7.67	8.98	9.89	11.01
EI (LB-IN-SQ)	.15815+06	.48398+06	.11419+07	.21414+07	.31511+07	.48503+07
ROOT SPRING (LB-IN/RAD)	.5781+04	.1338+05	.2546+05	.4081+05	.5452+05	.7534+05
BUCKLING CAPABILITY RATIO	29.29	17.08	11.24	8.29	6.88	5.59
STRENGTH CAPABILITY RATIO	.39	.87	1.62	2.53	3.32	4.46
* CANNISTER PROPERTIES *						
HEIGHT (IN)	25.44	27.64	29.72	31.56	32.84	34.42
DIAMETER (IN)	5.52	7.30	9.05	10.59	11.67	13.00
* WEIGHTS (LB) *						
ARRAY	221.0	225.6	232.0	239.0	244.9	253.6
BOOM	2.7	4.8	7.5	10.3	12.5	15.6
CANNISTER	3.3	5.8	8.9	12.2	14.8	18.3
TENSION MECHANISM	1.1	1.2	1.6	2.2	2.8	3.7
MAST SLEEVE	1.8	2.1	2.4	2.7	2.9	3.2
SHAFT	5.8	5.7	5.6	5.5	5.5	6.1
HEADER	2.6	2.7	2.9	3.1	3.4	3.8
DRUM BEARING	1.5	1.5	1.6	1.7	1.7	1.9
CENTER SUPPORT	12.5	12.3	12.3	12.2	12.1	12.1
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.5	8.5	8.5	8.5	8.5	8.5
LEADING EDGE MEMBERS	4.1	4.0	4.0	4.0	4.0	4.0
DRUMS	23.0	22.8	22.6	22.5	22.5	22.4
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 25.0 KW ARRAY WIDTH = 8.00 M

BLANKET AREA = .27778+06 IN=SQ BLANKET WEIGHT = 152.5 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.013	.023	.034	.046	.055	.068
***** TORSIONAL FREQUENCY HZ *****	.013	.023	.034	.046	.055	.068
***** BENDING FREQUENCY HZ *****	.025	.044	.067	.091	.110	.136
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	141.7	141.7	141.7	140.2	139.8	139.3
ARRAY LENGTH (M)	24.89	24.89	24.89	25.16	25.24	25.33
ASPECT RATIO	3.11	3.11	3.11	3.14	3.15	3.17
ARRAY MASS (KG)	101.8	103.9	106.6	109.4	111.8	115.6
ARRAY WEIGHT (LB)	224.0	228.5	234.5	240.6	245.9	254.4
CENTER OF GRAVITY (IN)	372.9	370.2	366.7	367.9	366.3	362.8
TENSION PER BLANKET (LB)	.50	1.50	3.50	6.50	9.50	14.50
MOMENT OF INERTIA I1	.5681+08	.5757+08	.5858+08	.6102+08	.6237+08	.6428+08
MOMENT OF INERTIA I2	.1634+07	.1634+07	.1635+07	.1599+07	.1590+07	.1579+07
SPECIFIC POWER (KW/KG)	.246	.241	.235	.229	.224	.216
SPECIFIC WEIGHT (KG/KW)	4.1	4.2	4.3	4.4	4.5	4.6
BLANKET - MAST CLEARANCE (IN)	13.5	12.8	12.1	13.0	13.0	13.0
* BOOM PROPERTIES *						
DIAMETER (IN)	4.49	5.91	7.31	8.58	9.45	10.52
EI (LB=IN=SQ)	.13900+06	.41699+06	.97297+06	.18463+07	.27148+07	.41748+07
ROOT SPRING (LB=IN/RAD)	.5248+04	.1196+05	.2258+05	.3651+05	.4876+05	.6733+05
BUCKLING CAPABILITY RATIO	26.99	15.58	10.20	7.57	6.28	5.10
STRENGTH CAPABILITY RATIO	.36	.82	1.52	2.38	3.13	4.22
* CANNISTER PROPERTIES *						
HEIGHT (IN)	24.39	26.31	28.19	30.10	31.33	32.85
DIAMETER (IN)	5.30	6.98	8.62	10.12	11.15	12.41
* WEIGHTS (LB) *						
ARRAY	224.0	228.5	234.5	240.6	245.9	254.4
BOOM	2.4	4.2	6.5	9.0	11.0	13.7
CANNISTER	3.1	5.3	8.1	11.1	13.5	16.8
TENSION MECHANISM	1.1	1.2	1.6	2.1	2.7	3.5
MAST SLEEVE	1.7	2.0	2.2	2.5	2.7	2.9
SHAFT	6.6	6.6	6.6	6.5	6.4	7.4
HEADER	2.6	2.7	2.9	3.2	3.5	4.0
DRUM BEARING	1.5	1.5	1.6	1.7	1.7	1.9
CENTER SUPPORT	13.6	13.6	13.6	13.4	13.3	13.3
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.5	8.5	8.5	8.5	8.5	8.5
LEADING EDGE MEMBERS	4.3	4.3	4.3	4.3	4.3	4.3
DRUMS	24.5	24.5	24.5	24.2	24.2	24.1
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 30.0 KW   ARRAY WIDTH = 5.00 M

BLANKET AREA = .33333+06 IN=SQ   BLANKET WEIGHT = 183.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.008	.018	.027	.033	.042	.049
***** TORSIONAL FREQUENCY HZ *****	.008	.018	.027	.033	.042	.049
***** BENDING FREQUENCY HZ *****	.016	.036	.052	.065	.084	.101
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	81.9	80.1	78.9	78.2	77.1	76.3
ARRAY LENGTH (M)	51.72	52.86	53.64	54.15	54.88	55.45
ASPECT RATIO	10.34	10.57	10.73	10.83	10.98	11.09
ARRAY MASS (KG)	112.3	122.6	132.3	139.6	151.8	162.7
ARRAY WEIGHT (LB)	247.0	269.8	291.0	307.1	333.9	357.9
CENTER OF GRAVITY (IN)	844.8	835.0	823.3	813.5	799.2	788.2
TENSION PER BLANKET (LB)	.50	2.50	5.50	8.50	14.50	21.00
MOMENT OF INERTIA I1	.2905+09	.3204+09	.3458+09	.3642+09	.3945+09	.4216+09
MOMENT OF INERTIA I2	.6002+06	.5739+06	.5572+06	.5466+06	.5325+06	.5217+06
SPECIFIC POWER (KW/KG)	.267	.245	.227	.215	.198	.184
SPECIFIC WEIGHT (KG/KW)	3.7	4.1	4.4	4.7	5.1	5.4
BLANKET - MAST CLEARANCE (IN)	12.8	12.6	12.5	12.3	12.1	12.0
* BOOM PROPERTIES *						
DIAMETER (IN)	7.54	11.48	14.08	15.89	18.28	20.16
EI (LB-IN-SQ)	.60007+06	.31343+07	.71001+07	.11184+08	.19593+08	.28977+08
ROOT SPRING (LB-IN/RAD)	.1572+05	.5430+05	.1003+06	.1410+06	.2147+06	.2879+06
BUCKLING CAPABILITY RATIO	75.96	35.24	24.11	19.86	15.41	12.94
STRENGTH CAPABILITY RATIO	.69	2.25	3.90	5.37	7.66	9.72
* CANNISTER PROPERTIES *						
HEIGHT (IN)	36.70	41.31	44.68	46.49	49.57	51.99
DIAMETER (IN)	8.89	13.55	16.62	18.75	21.58	23.79
* WEIGHTS (LB) *						
ARRAY	247.0	269.8	291.0	307.1	333.9	357.9
BOOM	7.8	18.0	27.4	34.2	45.9	56.5
CANNISTER	8.3	19.3	29.0	36.9	48.9	59.5
TENSION MECHANISM	1.4	1.9	3.1	3.8	6.0	7.6
MAST SLEEVE	4.2	5.7	6.7	7.5	8.5	9.3
SHAFT	2.5	2.4	2.3	2.3	2.2	2.5
HEADER	2.6	2.6	2.7	2.8	3.0	3.2
DRUM BEARING	1.5	1.5	1.6	1.7	1.9	2.1
CENTER SUPPORT	8.3	8.2	8.1	8.0	8.0	7.9
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.9	8.9	8.9	8.9	8.9	8.9
LEADING EDGE MEMBERS	2.5	2.4	2.4	2.4	2.4	2.3
DRUMS	14.4	14.1	13.9	13.8	13.6	13.5
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 30.0 KW   ARRAY WIDTH = 5.50 M

BLANKET AREA = .33333+06 IN-SQ   BLANKET WEIGHT = 183.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.009	.019	.028	.035	.045	.053
***** TORSIONAL FREQUENCY HZ *****	.009	.019	.028	.035	.045	.053
***** BENDING FREQUENCY HZ *****	.017	.038	.056	.069	.090	.107
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	91.9	90.3	89.2	88.5	87.5	86.8
ARRAY LENGTH (M)	46.04	46.88	47.45	47.83	48.35	48.77
ASPECT RATIO	8.37	8.52	8.63	8.70	8.79	8.87
ARRAY MASS (KG)	112.4	121.0	129.0	135.1	145.2	154.2
ARRAY WEIGHT (LB)	247.4	266.3	283.9	297.2	319.4	339.3
CENTER OF GRAVITY (IN)	746.4	739.5	730.3	722.6	710.9	701.4
TENSION PER BLANKET (LB)	.50	2.50	5.50	8.50	14.50	21.00
MOMENT OF INERTIA I1	.2292+09	.2488+09	.2653+09	.2771+09	.2964+09	.3135+09
MOMENT OF INERTIA I2	.7648+06	.7368+06	.7190+06	.7077+06	.6927+06	.6813+06
SPECIFIC POWER (KW/KG)	.267	.248	.232	.222	.207	.195
SPECIFIC WEIGHT (KG/KW)	3.7	4.0	4.3	4.5	4.8	5.1
BLANKET - MAST CLEARANCE (IN)	12.8	12.7	12.6	12.5	12.4	12.3
* BOOM PROPERTIES *						
DIAMETER (IN)	6.95	10.49	12.86	14.50	16.66	18.36
EI (LB-IN-SQ)	.47564+06	.24658+07	.55573+07	.87243+07	.15212+08	.22414+08
ROOT SPRING (LB-IN/RAD)	.1320+05	.4536+05	.8344+05	.1170+06	.1776+06	.2375+06
BUCKLING CAPABILITY RATIO	64.65	29.44	20.09	16.54	12.80	10.73
STRENGTH CAPABILITY RATIO	.61	1.96	3.43	4.75	6.81	8.69
* CANNISTER PROPERTIES *						
HEIGHT (IN)	34.24	38.82	41.89	43.50	46.28	48.47
DIAMETER (IN)	8.21	12.38	15.17	17.11	19.66	21.66
* WEIGHTS (LB) *						
ARRAY	247.4	266.3	283.9	297.2	319.4	339.3
BOOM	6.5	15.0	22.8	28.3	37.8	46.3
CANNISTER	7.1	16.2	24.3	30.9	40.8	49.5
TENSION MECHANISM	1.3	1.8	2.8	3.5	5.4	6.9
MAST SLEEVE	3.6	4.8	5.6	6.2	7.0	7.7
SHAFT	3.2	3.1	3.0	2.9	2.9	3.2
HEADER	2.6	2.7	2.8	2.9	3.1	3.4
DRUM BEARING	1.5	1.5	1.6	1.7	1.9	2.1
CENTER SUPPORT	9.2	9.0	8.9	8.9	8.8	8.7
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.9	8.9	8.9	8.9	8.9	8.9
LEADING EDGE MEMBERS	2.8	2.8	2.7	2.7	2.7	2.7
DRUMS	16.1	15.9	15.7	15.6	15.4	15.3
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 30.0 KW ARRAY WIDTH = 6.00 M

BLANKET AREA = .33333+06 IN=SQ BLANKET WEIGHT = 183.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.009	.021	.030	.037	.048	.056
***** TORSIONAL FREQUENCY HZ *****	.009	.021	.030	.037	.048	.056
***** BENDING FREQUENCY HZ *****	.018	.040	.059	.073	.095	.114
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	102.0	100.5	99.4	98.8	97.9	97.2
ARRAY LENGTH (M)	41.50	42.14	42.57	42.85	43.25	43.56
ASPECT RATIO	6.92	7.02	7.10	7.14	7.21	7.26
ARRAY MASS (KG)	113.0	120.3	127.1	132.3	140.8	148.6
ARRAY WEIGHT (LB)	248.7	264.7	279.7	291.0	309.9	326.9
CENTER OF GRAVITY (IN)	667.1	661.5	654.2	649.1	638.4	630.0
TENSION PER BLANKET (LB)	.50	2.50	5.50	8.50	14.50	21.00
MOMENT OF INERTIA I1	.1859+09	.1992+09	.2104+09	.2187+09	.2314+09	.2430+09
MOMENT OF INERTIA I2	.9505+06	.9211+06	.9024+06	.8905+06	.8748+06	.8629+06
SPECIFIC POWER (KW/KG)	.265	.249	.236	.227	.213	.202
SPECIFIC WEIGHT (KG/KW)	3.8	4.0	4.2	4.4	4.7	5.0
BLANKET - MAST CLEARANCE (IN)	12.9	12.8	12.7	12.7	12.5	12.4
* BOOM PROPERTIES *						
DIAMETER (IN)	6.40	9.72	11.90	13.31	15.40	16.96
EI (LB-IN-SQ)	.38646+06	.19921+07	.44723+07	.70032+07	.12168+08	.17878+08
ROOT SPRING (LB-IN/RAD)	.1130+05	.3865+05	.7090+05	.9924+05	.1502+06	.2004+06
BUCKLING CAPABILITY RATIO	54.80	25.27	17.21	13.94	10.94	9.15
STRENGTH CAPABILITY RATIO	.53	1.75	3.08	4.18	6.18	7.92
* CANNISTER PROPERTIES *						
HEIGHT (IN)	32.72	36.59	39.42	41.26	43.45	45.46
DIAMETER (IN)	7.55	11.47	14.04	15.71	18.17	20.01
* WEIGHTS (LB) *						
ARRAY	248.7	264.7	279.7	291.0	309.9	326.9
BOOM	5.6	12.7	19.2	24.2	31.7	38.7
CANNISTER	6.1	13.9	20.9	26.2	35.0	42.4
TENSION MECHANISM	1.2	1.7	2.7	3.3	5.0	6.3
MAST SLEEVE	3.1	4.1	4.8	5.3	6.0	6.5
SHAFT	3.9	3.8	3.7	3.7	3.6	4.1
HEADER	2.6	2.7	2.8	3.0	3.3	3.6
DRUM BEARING	1.5	1.5	1.6	1.7	1.9	2.1
CENTER SUPPORT	10.1	10.0	9.9	9.8	9.7	9.7
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.9	8.9	8.9	8.9	8.9	8.9
LEADING EDGE MEMBERS	3.1	3.1	3.0	3.0	3.0	3.0
DRUMS	17.9	17.6	17.4	17.3	17.2	17.0
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 30.0 KW ARRAY WIDTH = 6.50 M

BLANKET AREA = .33333+06 IN=SQ BLANKET WEIGHT = 183.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.022	.032	.039	.050	.060
***** TORSIONAL FREQUENCY HZ *****	.010	.022	.032	.039	.050	.060
***** BENDING FREQUENCY HZ *****	.019	.042	.062	.077	.100	.120
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	112.0	110.6	109.6	109.0	108.1	107.5
ARRAY LENGTH (M)	37.79	38.29	38.63	38.85	39.15	39.39
ASPECT RATIO	5.81	5.89	5.94	5.98	6.02	6.06
ARRAY MASS (KG)	113.9	120.3	126.2	130.6	138.0	144.9
ARRAY WEIGHT (LB)	250.7	264.6	277.5	287.3	303.7	318.9
CENTER OF GRAVITY (IN)	601.0	597.1	591.5	587.5	578.9	571.5
TENSION PER BLANKET (LB)	.50	2.50	5.50	8.50	14.50	21.00
MOMENT OF INERTIA I1	.1540+09	.1636+09	.1716+09	.1775+09	.1866+09	.1949+09
MOMENT OF INERTIA I2	.1157+07	.1126+07	.1107+07	.1094+07	.1078+07	.1066+07
SPECIFIC POWER (KW/KG)	.263	.249	.238	.230	.217	.207
SPECIFIC WEIGHT (KG/KW)	3.8	4.0	4.2	4.4	4.6	4.8
BLANKET - MAST CLEARANCE (IN)	12.9	12.9	12.8	12.8	12.7	12.6
* BOOM PROPERTIES *						
DIAMETER (IN)	6.01	9.05	11.07	12.38	14.32	15.75
EI (LB-IN-SQ)	.32047+06	.16449+07	.36823+07	.57553+07	.99734+07	.14623+08
ROOT SPRING (LB-IN/RAD)	.9819+04	.3348+05	.6128+05	.8566+05	.1294+06	.1724+06
BUCKLING CAPABILITY RATIO	48.35	21.91	14.90	12.05	9.45	7.90
STRENGTH CAPABILITY RATIO	.48	1.57	2.76	3.76	5.58	7.17
* CANNISTER PROPERTIES *						
HEIGHT (IN)	30.86	34.85	37.50	39.22	41.24	43.11
DIAMETER (IN)	7.10	10.68	13.07	14.61	16.89	18.59
* WEIGHTS (LB) *						
ARRAY	250.7	264.6	277.5	287.3	303.7	318.9
BOOM	4.8	11.0	16.6	20.8	27.2	33.2
CANNISTER	5.4	12.1	18.2	22.7	30.3	36.7
TENSION MECHANISM	1.2	1.6	2.5	3.1	4.7	5.9
MAST SLEEVE	2.8	3.6	4.2	4.6	5.2	5.6
SHAFT	4.8	4.6	4.6	4.5	4.4	5.2
HEADER	2.6	2.7	2.9	3.1	3.4	3.8
DRUM BEARING	1.5	1.5	1.6	1.7	1.9	2.1
CENTER SUPPORT	11.2	11.0	10.9	10.9	10.8	10.7
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.9	8.9	8.9	8.9	8.9	8.9
LEADING EDGE MEMBERS	3.4	3.4	3.4	3.3	3.3	3.3
DRUMS	19.5	19.3	19.1	19.0	18.9	18.8
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 30.0 KW ARRAY WIDTH = 7.00 M

BLANKET AREA = .33333+06 IN=SQ BLANKET WEIGHT = 183.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.023	.033	.041	.053	.063
***** TORSIONAL FREQUENCY HZ *****	.010	.023	.033	.041	.053	.063
***** BENDING FREQUENCY HZ *****	.020	.044	.065	.080	.104	.125
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	122.0	120.6	119.7	119.1	118.3	117.7
ARRAY LENGTH (M)	34.70	35.10	35.36	35.54	35.78	35.97
ASPECT RATIO	4.96	5.01	5.05	5.08	5.11	5.14
ARRAY MASS (KG)	115.1	120.7	125.9	129.8	136.3	142.7
ARRAY WEIGHT (LB)	253.2	265.4	276.9	285.5	299.9	313.8
CENTER OF GRAVITY (IN)	545.6	542.4	538.0	534.8	528.8	522.0
TENSION PER BLANKET (LB)	.50	2.50	5.50	8.50	14.50	21.00
MOMENT OF INERTIA I1	.1298+09	.1369+09	.1428+09	.1472+09	.1542+09	.1604+09
MOMENT OF INERTIA I2	.1387+07	.1354+07	.1334+07	.1321+07	.1304+07	.1291+07
SPECIFIC POWER (KW/KG)	.261	.249	.238	.231	.220	.210
SPECIFIC WEIGHT (KG/KW)	3.8	4.0	4.2	4.3	4.5	4.8
BLANKET - MAST CLEARANCE (IN)	13.0	12.9	12.9	12.8	12.8	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	5.63	8.53	10.43	11.65	13.36	14.70
EI (LB-IN-SQ)	.27011+06	.13817+07	.30860+07	.48162+07	.83286+07	.12191+08
ROOT SPRING (LB-IN/RAD)	.8637+04	.2938+05	.5368+05	.7495+05	.1130+06	.1504+06
BUCKLING CAPABILITY RATIO	42.30	19.45	13.21	10.68	8.23	6.88
STRENGTH CAPABILITY RATIO	.43	1.44	2.54	3.47	5.03	6.48
* CANNISTER PROPERTIES *						
HEIGHT (IN)	29.71	33.11	35.62	37.24	39.50	41.27
DIAMETER (IN)	6.64	10.06	12.30	13.75	15.77	17.34
* WEIGHTS (LB) *						
ARRAY	253.2	265.4	276.9	285.5	299.9	313.8
BOOM	4.2	9.5	14.3	18.0	23.8	29.0
CANNISTER	4.7	10.8	16.2	20.2	26.6	32.1
TENSION MECHANISM	1.2	1.6	2.4	2.9	4.4	5.5
MAST SLEEVE	2.5	3.2	3.8	4.1	4.6	4.9
SHAFT	5.7	5.6	5.5	5.4	5.3	6.6
HEADER	2.6	2.7	3.0	3.2	3.6	4.1
DRUM BEARING	1.5	1.5	1.6	1.7	1.9	2.1
CENTER SUPPORT	12.4	12.2	12.1	12.0	11.9	11.8
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.9	8.9	8.9	8.9	8.9	8.9
LEADING EDGE MEMBERS	3.7	3.7	3.7	3.6	3.6	3.6
DRUMS	21.2	21.0	20.9	20.8	20.6	20.5
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT　　POWER/WING = 30.0 KW　　ARRAY WIDTH = 7.50 M

BLANKET AREA = .33333+06 IN-SQ　　BLANKET WEIGHT = 183.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.023	.034	.042	.055	.065
***** TORSIONAL FREQUENCY HZ *****	.011	.023	.034	.042	.055	.065
***** BENDING FREQUENCY HZ *****	.021	.045	.067	.083	.109	.130
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	132.9	130.7	129.8	129.3	128.5	127.9
ARRAY LENGTH (M)	31.86	32.40	32.61	32.75	32.95	33.10
ASPECT RATIO	4.25	4.32	4.35	4.37	4.39	4.41
ARRAY MASS (KG)	116.6	121.4	126.1	129.5	135.4	141.4
ARRAY WEIGHT (LB)	256.6	267.1	277.3	285.0	297.9	311.2
CENTER OF GRAVITY (IN)	494.2	495.7	492.2	489.8	485.0	478.4
TENSION PER BLANKET (LB)	.50	2.50	5.50	8.50	14.50	21.00
MOMENT OF INERTIA I1	.1096+09	.1164+09	.1209+09	.1243+09	.1297+09	.1345+09
MOMENT OF INERTIA I2	.1662+07	.1605+07	.1583+07	.1570+07	.1553+07	.1540+07
SPECIFIC POWER (KW/KG)	.257	.247	.238	.232	.222	.212
SPECIFIC WEIGHT (KG/KW)	3.9	4.0	4.2	4.3	4.5	4.7
BLANKET - MAST CLEARANCE (IN)	12.1	12.9	12.9	12.9	12.8	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	5.30	8.06	9.85	11.01	12.62	13.87
EI (LB-IN-SQ)	.22773+06	.11773+07	.26247+07	.40913+07	.70630+07	.10325+08
ROOT SPRING (LB-IN/RAD)	.7600+04	.2606+05	.4754+05	.6632+05	.9988+05	.1328+06
BUCKLING CAPABILITY RATIO	37.59	17.38	11.79	9.53	7.34	6.13
STRENGTH CAPABILITY RATIO	.39	1.32	2.34	3.19	4.65	6.00
* CANNISTER PROPERTIES *						
HEIGHT (IN)	28.28	31.68	34.07	35.61	37.76	39.44
DIAMETER (IN)	6.26	9.51	11.62	12.99	14.89	16.37
* WEIGHTS (LB) *						
ARRAY	256.6	267.1	277.3	285.0	297.9	311.2
BOOM	3.7	8.4	12.6	15.8	20.9	25.4
CANNISTER	4.2	9.7	14.5	18.1	23.8	28.7
TENSION MECHANISM	1.1	1.5	2.3	2.8	4.2	5.2
MAST SLEEVE	2.2	2.9	3.4	3.7	4.1	4.4
SHAFT	6.8	6.6	6.5	6.4	6.3	8.2
HEADER	2.6	2.8	3.0	3.3	3.8	4.3
DRUM BEARING	1.5	1.5	1.6	1.7	1.9	2.1
CENTER SUPPORT	13.8	13.5	13.4	13.3	13.2	13.1
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.9	8.9	8.9	8.9	8.9	8.9
LEADING EDGE MEMBERS	4.1	4.0	4.0	4.0	3.9	3.9
DRUMS	23.1	22.7	22.6	22.5	22.3	22.2
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 30.0 KW   ARRAY WIDTH = 8.00 M

BLANKET AREA = .33333+06 IN-SQ   BLANKET WEIGHT = 183.0 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.024	.036	.044	.057	.068
***** TORSIONAL FREQUENCY HZ *****	.011	.024	.036	.044	.057	.068
***** BENDING FREQUENCY HZ *****	.021	.047	.070	.087	.113	.135
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	141.7	140.7	139.8	139.3	138.6	138.0
ARRAY LENGTH (M)	29.87	30.09	30.27	30.39	30.55	30.68
ASPECT RATIO	3.73	3.76	3.78	3.80	3.82	3.83
ARRAY MASS (KG)	118.1	122.5	126.7	129.8	135.2	141.1
ARRAY WEIGHT (LB)	259.7	269.5	278.7	285.6	297.3	310.3
CENTER OF GRAVITY (IN)	457.7	455.4	452.8	450.9	447.2	440.6
TENSION PER BLANKET (LB)	.50	2.50	5.50	8.50	14.50	21.00
MOMENT OF INERTIA I1	.9644+08	.1004+09	.1039+09	.1066+09	.1109+09	.1148+09
MOMENT OF INERTIA I2	.1907+07	.1878+07	.1855+07	.1842+07	.1824+07	.1811+07
SPECIFIC POWER (KW/KG)	.254	.245	.237	.231	.222	.213
SPECIFIC WEIGHT (KG/KW)	3.9	4.1	4.2	4.3	4.5	4.7
BLANKET - MAST CLEARANCE (IN)	13.2	13.0	13.0	13.0	12.9	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	5.09	7.64	9.34	10.43	11.95	13.14
EI (LB-IN-SQ)	.20015+06	.10159+07	.22616+07	.35219+07	.60722+07	.88674+07
ROOT SPRING (LB-IN/RAD)	.6898+04	.2333+05	.4251+05	.5927+05	.8917+05	.1185+06
BUCKLING CAPABILITY RATIO	34.66	15.62	10.59	8.55	6.58	5.49
STRENGTH CAPABILITY RATIO	.37	1.22	2.16	2.94	4.29	5.54
* CANNISTER PROPERTIES *						
HEIGHT (IN)	27.07	30.50	32.79	34.27	36.34	37.94
DIAMETER (IN)	6.01	9.02	11.02	12.31	14.10	15.50
* WEIGHTS (LB) *						
ARRAY	259.7	269.5	278.7	285.6	297.3	310.3
BOOM	3.3	7.5	11.2	14.1	18.6	22.5
CANNISTER	3.9	8.8	13.1	16.3	21.4	25.9
TENSION MECHANISM	1.1	1.5	2.2	2.6	4.0	5.0
MAST SLEEVE	2.1	2.7	3.1	3.3	3.7	4.0
SHAFT	7.8	7.6	7.5	7.5	7.4	10.0
HEADER	2.6	2.8	3.1	3.4	4.0	4.6
DRUM BEARING	1.5	1.5	1.6	1.7	1.9	2.1
CENTER SUPPORT	15.0	14.9	14.8	14.7	14.6	14.5
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	8.9	8.9	8.9	8.9	8.9	8.9
LEADING EDGE MEMBERS	4.3	4.3	4.3	4.3	4.2	4.2
DRUMS	24.6	24.4	24.3	24.2	24.1	24.0
LATCHES	.3	.3	.3	.3	.3	.3

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE GF ROLLOUT　　POWER/WING = 35.0 KW　　ARRAY WIDTH = 6.00 M

BLANKET AREA = .38889+06 IN-SQ　　BLANKET WEIGHT = 213.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.008	.018	.027	.035	.043	.052
***** TORSIONAL FREQUENCY HZ *****	.008	.018	.027	.035	.043	.052
***** BENDING FREQUENCY HZ *****	.015	.034	.052	.069	.086	.106
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	101.6	99.9	98.6	97.6	96.7	95.8
ARRAY LENGTH (M)	48.60	49.44	50.09	50.59	51.05	51.54
ASPECT RATIO	8.10	8.24	8.35	8.43	8.51	8.59
ARRAY MASS (KG)	129.4	138.7	148.4	157.7	167.7	179.8
ARRAY WEIGHT (LB)	284.7	305.1	326.5	346.8	368.8	395.5
CENTER OF GRAVITY (IN)	792.0	784.8	774.9	763.9	753.5	740.9
TENSION PER BLANKET (LB)	.50	2.50	6.00	10.50	16.50	25.00
MOMENT OF INERTIA I1	.2948+09	.3185+09	.3410+09	.3609+09	.3824+09	.4077+09
MOMENT OF INERTIA I2	.1083+07	.1046+07	.1019+07	.9988+06	.9811+06	.9636+06
SPECIFIC POWER (KW/KG)	.270	.252	.236	.222	.209	.195
SPECIFIC WEIGHT (KG/KW)	3.7	4.0	4.2	4.5	4.8	5.1
BLANKET - MAST CLEARANCE (IN)	12.9	12.8	12.6	12.5	12.4	12.3
* BOOM PROPERTIES *						
DIAMETER (IN)	7.20	10.94	13.70	15.96	17.95	20.01
EI (LB-IN-SQ)	.52998+06	.27425+07	.67536+07	.12056+08	.19298+08	.29801+08
ROOT SPRING (LB-IN/RAD)	.1432+05	.4913+05	.9658+05	.1492+06	.2123+06	.2940+06
BUCKLING CAPABILITY RATIO	69.28	32.00	20.92	16.21	13.05	10.71
STRENGTH CAPABILITY RATIO	.55	1.83	3.40	5.13	6.96	9.14
* CANNISTER PROPERTIES *						
HEIGHT (IN)	35.51	39.81	43.33	45.68	48.20	50.81
DIAMETER (IN)	8.49	12.91	16.17	18.83	21.18	23.61
* WEIGHTS (LB) *						
ARRAY	284.7	305.1	326.5	346.8	368.8	395.5
BOOM	7.1	16.2	25.7	34.2	43.7	54.8
CANNISTER	7.6	17.6	27.5	37.3	47.2	58.7
TENSION MECHANISM	1.3	1.9	2.9	4.2	6.0	8.4
MAST SLEEVE	3.8	5.2	6.2	7.1	7.8	8.6
SHAFT	4.5	4.3	4.2	4.1	4.1	4.6
HEADER	2.6	2.7	2.9	3.1	3.4	3.7
DRUM BEARING	1.5	1.5	1.6	1.8	2.0	2.2
CENTER SUPPORT	10.8	10.6	10.5	10.4	10.3	10.2
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	9.3	9.3	9.3	9.3	9.3	9.3
LEADING EDGE MEMBERS	3.1	3.1	3.0	3.0	3.0	2.9
DRUMS	17.9	17.6	17.4	17.2	17.1	16.9
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 35.0 KW ARRAY WIDTH = 6.50 M

BLANKET AREA = .38889+06 IN-SQ BLANKET WEIGHT = 213.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.008	.019	.028	.037	.046	.055
***** TORSIONAL FREQUENCY HZ *****	.008	.019	.028	.037	.046	.055
***** BENDING FREQUENCY HZ *****	.016	.036	.055	.073	.091	.111
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	111.7	110.0	108.8	107.9	107.1	106.2
ARRAY LENGTH (M)	44.23	44.88	45.37	45.76	46.12	46.49
ASPECT RATIO	6.80	6.90	6.98	7.04	7.10	7.15
ARRAY MASS (KG)	130.2	138.2	146.6	154.5	163.2	173.9
ARRAY WEIGHT (LB)	286.5	304.1	322.6	340.0	359.0	382.5
CENTER OF GRAVITY (IN)	713.9	708.5	700.6	692.9	683.2	671.9
TENSION PER BLANKET (LB)	.50	2.50	6.00	10.50	16.50	25.00
MOMENT OF INERTIA I1	.2436+09	.2604+09	.2763+09	.2908+09	.3055+09	.3232+09
MOMENT OF INERTIA I2	.1320+07	.1280+07	.1252+07	.1231+07	.1213+07	.1195+07
SPECIFIC POWER (KW/KG)	.269	.253	.239	.226	.214	.201
SPECIFIC WEIGHT (KG/KW)	3.7	3.9	4.2	4.4	4.7	5.0
BLANKET - MAST CLEARANCE (IN)	12.9	12.8	12.7	12.7	12.5	12.4
* BOOM PROPERTIES *						
DIAMETER (IN)	6.71	10.19	12.75	14.73	16.68	18.58
EI (LB-IN-SQ)	.43883+06	.22594+07	.55428+07	.98653+07	.15747+08	.24247+08
ROOT SPRING (LB-IN/RAD)	.1243+05	.4248+05	.8328+05	.1283+06	.1822+06	.2519+06
BUCKLING CAPABILITY RATIO	60.23	27.76	18.11	13.81	11.27	9.23
STRENGTH CAPABILITY RATIO	.49	1.64	3.07	4.53	6.33	8.35
* CANNISTER PROPERTIES *						
HEIGHT (IN)	33.81	37.80	41.07	43.60	45.56	47.98
DIAMETER (IN)	7.92	12.02	15.05	17.38	19.68	21.93
* WEIGHTS (LB) *						
ARRAY	286.5	304.1	322.6	340.0	359.0	382.5
BOOM	6.2	14.0	22.1	29.7	37.3	46.6
CANNISTER	6.6	15.3	23.9	31.9	40.9	50.8
TENSION MECHANISM	1.3	1.8	2.8	3.9	5.5	7.8
MAST SLEEVE	3.4	4.5	5.4	6.1	6.7	7.4
SHAFT	5.4	5.3	5.2	5.1	5.0	5.9
HEADER	2.6	2.7	2.9	3.2	3.5	4.0
DRUM BEARING	1.5	1.5	1.6	1.8	2.0	2.2
CENTER SUPPORT	12.1	11.9	11.7	11.6	11.5	11.4
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	9.3	9.3	9.3	9.3	9.3	9.3
LEADING EDGE MEMBERS	3.4	3.4	3.3	3.3	3.3	3.2
DRUMS	19.6	19.3	19.1	19.0	18.8	18.7
LATCHES	.3	.3	.3	.3	.3	.3

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE GE ROLLOUT POWER/WING = 35.0 KW ARRAY WIDTH = 7.00 M

BLANKET AREA = .38889+06 IN=SQ BLANKET WEIGHT = 213.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.009	.019	.030	.039	.048	.058
***** TORSIONAL FREQUENCY HZ *****	.009	.019	.030	.039	.048	.058
***** BENDING FREQUENCY HZ *****	.017	.037	.058	.076	.095	.116
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	121.7	120.1	119.0	118.1	117.3	116.5
ARRAY LENGTH (M)	40.59	41.11	41.50	41.81	42.09	42.39
ASPECT RATIO	5.80	5.87	5.93	5.97	6.01	6.06
ARRAY MASS (KG)	131.4	138.3	145.7	152.7	160.2	169.9
ARRAY WEIGHT (LB)	289.0	304.4	320.5	335.9	352.5	373.8
CENTER OF GRAVITY (IN)	648.1	644.3	638.2	631.3	624.4	614.1
TENSION PER BLANKET (LB)	.50	2.50	6.00	10.50	16.50	25.00
MOMENT OF INERTIA I1	.2050+09	.2175+09	.2292+09	.2396+09	.2507+09	.2638+09
MOMENT OF INERTIA I2	.1580+07	.1539+07	.1510+07	.1488+07	.1469+07	.1450+07
SPECIFIC POWER (KW/KG)	.266	.253	.240	.229	.218	.206
SPECIFIC WEIGHT (KG/KW)	3.8	4.0	4.2	4.4	4.6	4.9
BLANKET - MAST CLEARANCE (IN)	12.9	12.9	12.8	12.7	12.7	12.6
* BOOM PROPERTIES *						
DIAMETER (IN)	6.33	9.53	11.92	13.86	15.57	17.34
EI (LB-IN-SQ)	.36960+06	.18957+07	.46371+07	.82348+07	.13117+08	.20153+08
ROOT SPRING (LB-IN/RAD)	.1093+05	.3724+05	.7285+05	.1121+06	.1589+06	.2193+06
BUCKLING CAPABILITY RATIO	53.59	24.27	15.82	12.23	9.83	8.04
STRENGTH CAPABILITY RATIO	.45	1.47	2.76	4.20	5.74	7.59
* CANNISTER PROPERTIES *						
HEIGHT (IN)	32.08	36.21	39.29	41.29	43.48	45.75
DIAMETER (IN)	7.47	11.24	14.06	16.36	18.38	20.46
* WEIGHTS (LB) *						
ARRAY	289.0	304.4	320.5	335.9	352.5	373.8
BOOM	5.3	12.3	19.4	25.6	32.5	40.6
CANNISTER	5.9	13.4	21.0	28.4	35.8	44.4
TENSION MECHANISM	1.2	1.7	2.6	3.7	5.2	7.2
MAST SLEEVE	3.0	4.0	4.7	5.4	5.9	6.5
SHAFT	6.5	6.3	6.2	6.1	6.0	7.5
HEADER	2.6	2.7	3.0	3.3	3.7	4.3
DRUM BEARING	1.5	1.5	1.6	1.8	2.0	2.2
CENTER SUPPORT	13.4	13.2	13.0	12.9	12.8	12.7
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	9.3	9.3	9.3	9.3	9.3	9.3
LEADING EDGE MEMBERS	3.7	3.7	3.6	3.6	3.6	3.6
DRUMS	21.3	21.0	20.8	20.7	20.5	20.4
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 35.0 KW   ARRAY WIDTH = 7.50 M

BLANKET AREA = .38889+06 IN-SQ   BLANKET WEIGHT = 213.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.009	.020	.031	.040	.050	.061
***** TORSIONAL FREQUENCY HZ *****	.009	.020	.031	.040	.050	.061
***** BENDING FREQUENCY HZ *****	.018	.039	.060	.079	.099	.121
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	131.7	130.2	129.1	128.3	127.5	126.8
ARRAY LENGTH (M)	37.51	37.93	38.25	38.49	38.72	38.96
ASPECT RATIO	5.00	5.06	5.10	5.13	5.16	5.19
ARRAY MASS (KG)	132.8	138.9	145.5	151.7	158.4	167.5
ARRAY WEIGHT (LB)	292.1	305.7	320.0	333.7	348.5	368.4
CENTER OF GRAVITY (IN)	592.1	589.1	584.2	579.4	574.1	563.3
TENSION PER BLANKET (LB)	.50	2.50	6.00	10.50	16.50	25.00
MOMENT OF INERTIA I1	.1751+09	.1845+09	.1934+09	.2015+09	.2101+09	.2198+09
MOMENT OF INERTIA I2	.1866+07	.1823+07	.1793+07	.1770+07	.1751+07	.1732+07
SPECIFIC POWER (KW/KG)	.264	.252	.241	.231	.221	.209
SPECIFIC WEIGHT (KG/KW)	3.8	4.0	4.2	4.3	4.5	4.8
BLANKET - MAST CLEARANCE (IN)	13.0	12.9	12.9	12.8	12.8	12.7
* BOOM PROPERTIES *						
DIAMETER (IN)	5.94	9.01	11.26	12.99	14.59	16.37
EI (LB-IN-SQ)	.31562+06	.16138+07	.39383+07	.69812+07	.11101+08	.17026+08
ROOT SPRING (LB-IN/RAD)	.9707+04	.3301+05	.6445+05	.9901+05	.1402+06	.1932+06
BUCKLING CAPABILITY RATIO	47.23	21.70	14.13	10.75	8.62	7.16
STRENGTH CAPABILITY RATIO	.41	1.36	2.55	3.79	5.19	7.06
* CANNISTER PROPERTIES *						
HEIGHT (IN)	31.03	34.57	37.49	39.75	41.82	43.58
DIAMETER (IN)	7.01	10.63	13.29	15.33	17.22	19.31
* WEIGHTS (LB) *						
ARRAY	292.1	305.7	320.0	333.7	348.5	368.4
BOOM	4.8	10.8	17.0	22.7	28.8	35.4
CANNISTER	5.2	12.0	18.8	25.0	31.6	39.6
TENSION MECHANISM	1.2	1.6	2.5	3.5	4.9	6.8
MAST SLEEVE	2.7	3.6	4.2	4.8	5.2	5.8
SHAFT	7.6	7.5	7.3	7.2	7.2	9.3
HEADER	2.6	2.8	3.1	3.4	3.9	4.6
DRUM BEARING	1.5	1.5	1.6	1.8	2.0	2.2
CENTER SUPPORT	14.9	14.7	14.5	14.4	14.3	14.1
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	9.3	9.3	9.3	9.3	9.3	9.3
LEADING EDGE MEMBERS	4.0	4.0	4.0	3.9	3.9	3.9
DRUMS	23.0	22.7	22.5	22.4	22.3	22.1
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 35.0 KW   ARRAY WIDTH = 8.00 M

BLANKET AREA = .38889+06 IN-SQ   BLANKET WEIGHT = 213.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.009	.021	.032	.042	.052	.063
***** TORSIONAL FREQUENCY HZ *****	.009	.021	.032	.042	.052	.063
***** BENDING FREQUENCY HZ *****	.018	.040	.062	.082	.103	.126
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	141.7	140.3	139.2	138.4	137.7	137.0
ARRAY LENGTH (M)	34.85	35.21	35.47	35.67	35.86	36.05
ASPECT RATIO	4.36	4.40	4.43	4.46	4.48	4.51
ARRAY MASS (KG)	134.4	139.9	145.8	151.3	157.4	166.1
ARRAY WEIGHT (LB)	295.7	307.8	320.7	332.9	346.3	365.5
CENTER OF GRAVITY (IN)	543.1	541.2	537.5	533.7	529.5	520.0
TENSION PER BLANKET (LB)	.50	2.50	6.00	10.50	16.50	25.00
MOMENT OF INERTIA I1	.1513+09	.1587+09	.1656+09	.1719+09	.1787+09	.1867+09
MOMENT OF INERTIA I2	.2180+07	.2134+07	.2102+07	.2079+07	.2059+07	.2040+07
SPECIFIC POWER (KW/KG)	.260	.250	.240	.231	.222	.211
SPECIFIC WEIGHT (KG/KW)	3.8	4.0	4.2	4.3	4.5	4.7
BLANKET - MAST CLEARANCE (IN)	12.9	12.9	12.9	12.9	12.8	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	5.64	8.54	10.67	12.31	13.82	15.37
EI (LB-IN-SQ)	.27243+06	.13908+07	.33875+07	.59958+07	.95210+07	.14582+08
ROOT SPRING (LB-IN/RAD)	.8693+04	.2952+05	.5756+05	.8833+05	.1250+06	.1720+06
BUCKLING CAPABILITY RATIO	42.49	19.51	12.69	9.65	7.74	6.32
STRENGTH CAPABILITY RATIO	.37	1.25	2.36	3.51	4.81	6.39
* CANNISTER PROPERTIES *						
HEIGHT (IN)	29.82	33.20	35.99	38.14	40.12	42.16
DIAMETER (IN)	6.65	10.08	12.59	14.52	16.30	18.14
* WEIGHTS (LB) *						
ARRAY	295.7	307.8	320.7	332.9	346.3	365.5
BOOM	4.3	9.6	15.1	20.2	25.5	31.8
CANNISTER	4.7	10.9	16.9	22.5	28.4	35.1
TENSION MECHANISM	1.2	1.6	2.4	3.3	4.6	6.4
MAST SLEEVE	2.5	3.3	3.8	4.3	4.7	5.1
SHAFT	8.9	8.7	8.6	8.5	8.4	11.5
HEADER	2.6	2.8	3.2	3.6	4.2	5.0
DRUM BEARING	1.5	1.5	1.6	1.8	2.0	2.2
CENTER SUPPORT	16.5	16.2	16.1	16.0	15.8	15.7
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	9.3	9.3	9.3	9.3	9.3	9.3
LEADING EDGE MEMBERS	4.3	4.3	4.3	4.2	4.2	4.2
DRUMS	24.7	24.4	24.3	24.1	24.0	23.9
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 35.0 KW ARRAY WIDTH = 8.50 M

BLANKET AREA = .38889+06 IN-SQ BLANKET WEIGHT = 213.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.022	.033	.043	.054	.065
***** TORSIONAL FREQUENCY HZ *****	.010	.022	.033	.043	.054	.065
***** BENDING FREQUENCY HZ *****	.019	.042	.065	.085	.107	.131
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	151.6	150.6	149.3	148.5	147.8	147.1
ARRAY LENGTH (M)	32.58	32.80	33.09	33.25	33.41	33.57
ASPECT RATIO	3.83	3.86	3.89	3.91	3.93	3.95
ARRAY MASS (KG)	136.2	141.2	146.5	151.6	157.1	165.8
ARRAY WEIGHT (LB)	299.6	310.7	322.3	333.4	345.6	364.7
CENTER OF GRAVITY (IN)	500.9	498.2	496.7	493.9	490.6	481.0
TENSION PER BLANKET (LB)	.50	2.50	6.00	10.50	16.50	25.00
MOMENT OF INERTIA I1	.1324+09	.1375+09	.1437+09	.1488+09	.1543+09	.1609+09
MOMENT OF INERTIA I2	.2515+07	.2481+07	.2437+07	.2413+07	.2392+07	.2374+07
SPECIFIC POWER (KW/KG)	.257	.248	.239	.231	.223	.211
SPECIFIC WEIGHT (KG/KW)	3.9	4.0	4.2	4.3	4.5	4.7
BLANKET - MAST CLEARANCE (IN)	13.0	12.7	13.0	13.0	12.9	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	5.41	8.11	10.14	11.69	13.12	14.59
EI (LB-IN-SQ)	.23809+06	.12066+07	.29472+07	.52103+07	.82647+07	.12644+08
ROOT SPRING (LB-IN/RAD)	.7857+04	.2654+05	.5185+05	.7950+05	.1124+06	.1546+06
BUCKLING CAPABILITY RATIO	39.07	17.59	11.46	8.70	6.98	5.69
STRENGTH CAPABILITY RATIO	.35	1.15	2.18	3.25	4.46	5.93
* CANNISTER PROPERTIES *						
HEIGHT (IN)	28.46	32.01	34.75	36.81	38.71	40.66
DIAMETER (IN)	6.38	9.57	11.97	13.80	15.48	17.22
* WEIGHTS (LB) *						
ARRAY	299.6	310.7	322.3	333.4	345.6	364.7
BOOM	3.8	8.6	13.5	18.1	22.9	28.5
CANNISTER	4.4	9.8	15.3	20.4	25.7	31.8
TENSION MECHANISM	1.1	1.5	2.3	3.2	4.4	6.1
MAST SLEEVE	2.3	3.0	3.5	3.9	4.3	4.6
SHAFT	10.2	10.1	9.9	9.8	9.7	14.1
HEADER	2.6	2.8	3.2	3.8	4.4	5.4
DRUM BEARING	1.5	1.5	1.6	1.8	2.0	2.2
CENTER SUPPORT	18.2	18.0	17.8	17.7	17.5	17.4
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	9.3	9.3	9.3	9.3	9.3	9.3
LEADING EDGE MEMBERS	4.6	4.6	4.6	4.5	4.5	4.5
DRUMS	26.4	26.2	26.0	25.8	25.7	25.6
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 35.0 KW ARRAY WIDTH = 9.00 M

BLANKET AREA = .38889+06 IN-SQ BLANKET WEIGHT = 213.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.022	.034	.045	.056	.068
***** TORSIONAL FREQUENCY HZ *****	.010	.022	.034	.045	.056	.068
***** BENDING FREQUENCY HZ *****	.019	.043	.067	.088	.110	.135
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	161.6	159.4	159.4	159.4	158.0	157.3
ARRAY LENGTH (M)	30.57	30.97	30.97	30.97	31.27	31.40
ASPECT RATIO	3.40	3.44	3.44	3.44	3.47	3.49
ARRAY MASS (KG)	138.2	142.6	147.6	152.3	157.6	166.2
ARRAY WEIGHT (LB)	304.0	313.7	324.7	335.1	346.7	365.6
CENTER OF GRAVITY (IN)	463.4	465.6	460.2	455.7	454.8	445.3
TENSION PER BLANKET (LB)	.50	2.50	6.00	10.50	16.50	25.00
MOMENT OF INERTIA I1	.1167+09	.1227+09	.1258+09	.1288+09	.1346+09	.1400+09
MOMENT OF INERTIA I2	.2880+07	.2802+07	.2804+07	.2807+07	.2755+07	.2738+07
SPECIFIC POWER (KW/KG)	.253	.245	.237	.230	.222	.211
SPECIFIC WEIGHT (KG/KW)	3.9	4.1	4.2	4.4	4.5	4.7
BLANKET - MAST CLEARANCE (IN)	13.0	13.8	12.9	12.2	12.9	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	5.15	7.75	9.65	11.10	12.59	14.00
EI (LB-IN-SQ)	.20963+06	.10763+07	.25831+07	.45203+07	.72387+07	.11063+08
ROOT SPRING (LB-IN/RAD)	.7142+04	.2436+05	.4697+05	.7147+05	.1017+06	.1398+06
BUCKLING CAPABILITY RATIO	35.47	16.08	10.38	7.84	6.42	5.24
STRENGTH CAPABILITY RATIO	.32	1.07	2.01	2.99	4.23	5.63
* CANNISTER PROPERTIES *						
HEIGHT (IN)	27.63	31.25	33.68	35.54	37.12	39.00
DIAMETER (IN)	6.08	9.15	11.39	13.10	14.86	16.52
* WEIGHTS (LB) *						
ARRAY	304.0	313.7	324.7	335.1	346.7	365.6
BOOM	3.4	7.9	12.3	16.2	20.4	25.3
CANNISTER	4.0	9.0	14.0	18.5	23.7	29.3
TENSION MECHANISM	1.1	1.5	2.2	3.0	4.2	5.9
MAST SLEEVE	2.1	2.7	3.2	3.5	3.9	4.3
SHAFT	11.7	11.4	11.4	11.4	11.7	17.0
HEADER	2.6	2.9	3.3	3.9	4.7	5.8
DRUM BEARING	1.5	1.5	1.6	1.8	2.0	2.2
CENTER SUPPORT	20.1	19.7	19.7	19.7	19.4	19.3
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	9.3	9.3	9.3	9.3	9.3	9.3
LEADING EDGE MEMBERS	4.9	4.9	4.9	4.9	4.8	4.8
DRUMS	28.0	27.7	27.7	27.7	27.4	27.3
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 40.0 KW   ARRAY WIDTH = 6.00 M

BLANKET AREA = .44444+06 IN*SQ   BLANKET WEIGHT = 244.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.017	.027	.035	.043	.051
***** TORSIONAL FREQUENCY HZ *****	.010	.017	.027	.035	.043	.051
***** BENDING FREQUENCY HZ *****	.019	.033	.053	.069	.087	.104
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	100.5	99.1	97.4	96.3	95.1	93.2
ARRAY LENGTH (M)	56.14	56.96	57.94	58.64	59.32	60.59
ASPECT RATIO	9.36	9.49	9.66	9.77	9.89	10.10
ARRAY MASS (KG)	149.7	159.4	174.7	188.4	203.8	220.6
ARRAY WEIGHT (LB)	329.3	350.6	384.4	414.4	448.3	485.2
CENTER OF GRAVITY (IN)	915.8	907.6	890.6	876.2	859.6	854.5
TENSION PER BLANKET (LB)	1.00	3.00	8.00	14.00	22.50	32.50
MOMENT OF INERTIA I1	.4541+09	.4862+09	.5324+09	.5718+09	.6148+09	.6762+09
MOMENT OF INERTIA I2	.1197+07	.1162+07	.1123+07	.1097+07	.1072+07	.1029+07
SPECIFIC POWER (KW/KG)	.267	.251	.229	.212	.196	.181
SPECIFIC WEIGHT (KG/KW)	3.7	4.0	4.4	4.7	5.1	5.5
BLANKET - MAST CLEARANCE (IN)	12.8	12.7	12.5	12.3	12.1	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	9.55	12.66	16.43	19.01	21.68	24.02
EI (LB-IN-SQ)	.14144+07	.43679+07	.12051+08	.21599+08	.35531+08	.53529+08
ROOT SPRING (LB-IN/RAD)	.2990+05	.6965+05	.1491+06	.2310+06	.3355+06	.4562+06
BUCKLING CAPABILITY RATIO	60.93	35.69	22.55	17.25	13.97	11.87
STRENGTH CAPABILITY RATIO	.96	2.13	4.33	6.33	8.85	11.18
* CANNISTER PROPERTIES *						
HEIGHT (IN)	39.91	43.82	48.04	51.27	54.06	57.29
DIAMETER (IN)	11.27	14.93	19.39	22.43	25.59	28.35
* WEIGHTS (LB) *						
ARRAY	329.3	350.6	384.4	414.4	448.3	485.2
BOOM	12.4	22.2	37.0	50.1	64.0	80.3
CANNISTER	13.3	23.4	39.4	52.8	68.6	84.2
TENSION MECHANISM	1.5	2.1	3.9	6.3	9.1	12.1
MAST SLEEVE	5.2	6.5	8.1	9.3	10.4	11.6
SHAFT	5.0	4.8	4.7	4.6	4.4	5.3
HEADER	2.6	2.7	2.9	3.2	3.6	4.0
DRUM BEARING	1.5	1.6	1.7	1.9	2.1	2.4
CENTER SUPPORT	11.5	11.3	11.1	10.9	10.8	10.5
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	9.7	9.7	9.7	9.7	9.7	9.7
LEADING EDGE MEMBERS	3.1	3.0	3.0	2.9	2.9	2.8
DRUMS	17.8	17.5	17.3	17.1	16.9	16.5
LATCHES	.3	.3	.3	.3	.3	.3

ORIGINAL PAGE IS
OF POOR QUALITY

ARRAY TYPE GE ROLLOUT   POWER/WING = 40.0 KW   ARRAY WIDTH = 6.50 M

BLANKET AREA = .44444+06 IN=SQ   BLANKET WEIGHT = 244.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.018	.028	.037	.046	.054
***** TORSIONAL FREQUENCY HZ *****	.010	.018	.028	.037	.046	.054
***** BENDING FREQUENCY HZ *****	.020	.034	.055	.073	.092	.110
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	110.7	109.3	107.7	106.6	105.6	104.7
ARRAY LENGTH (M)	51.01	51.64	52.40	52.93	53.46	53.92
ASPECT RATIO	7.85	7.95	8.06	8.14	8.22	8.29
ARRAY MASS (KG)	149.8	158.2	171.4	183.1	196.3	210.0
ARRAY WEIGHT (LB)	329.7	348.0	377.0	402.7	431.8	462.1
CENTER OF GRAVITY (IN)	826.0	819.6	805.8	793.9	781.8	766.2
TENSION PER BLANKET (LB)	1.00	3.00	8.00	14.00	22.50	32.50
MOMENT OF INERTIA I1	.3729+09	.3956+09	.4279+09	.4553+09	.4862+09	.5152+09
MOMENT OF INERTIA I2	.1461+07	.1425+07	.1384+07	.1357+07	.1331+07	.1310+07
SPECIFIC POWER (KW/KG)	.267	.253	.233	.219	.204	.190
SPECIFIC WEIGHT (KG/KW)	3.7	4.0	4.3	4.6	4.9	5.3
BLANKET - MAST CLEARANCE (IN)	12.8	12.8	12.6	12.5	12.4	12.2
* BOOM PROPERTIES *						
DIAMETER (IN)	8.90	11.79	15.29	17.67	19.99	22.18
EI (LB*IN*SQ)	.11675+07	.35902+07	.98555+07	.17600+08	.28849+08	.42392+08
ROOT SPRING (LB*IN/RAD)	.2589+05	.6013+05	.1282+06	.1981+06	.2870+06	.3830+06
BUCKLING CAPABILITY RATIO	52.98	30.97	19.53	14.91	11.88	10.12
STRENGTH CAPABILITY RATIO	.87	1.92	3.93	5.77	7.92	10.30
* CANNISTER PROPERTIES *						
HEIGHT (IN)	37.87	41.50	45.38	48.37	51.28	53.45
DIAMETER (IN)	10.50	13.91	18.04	20.85	23.59	26.17
* WEIGHTS (LB) *						
ARRAY	329.7	348.0	377.0	402.7	431.8	462.1
BOOM	10.7	19.1	31.6	42.6	55.1	66.4
CANNISTER	11.6	20.4	34.2	45.7	58.5	71.9
TENSION MECHANISM	1.4	2.0	3.6	5.8	8.4	11.0
MAST SLEEVE	4.6	5.7	7.0	8.0	8.9	9.8
SHAFT	6.0	5.9	5.7	5.6	5.5	7.1
HEADER	2.6	2.7	3.0	3.4	3.9	4.4
DRUM BEARING	1.5	1.6	1.7	1.9	2.1	2.4
CENTER SUPPORT	12.8	12.6	12.4	12.3	12.1	12.0
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	9.7	9.7	9.7	9.7	9.7	9.7
LEADING EDGE MEMBERS	3.4	3.3	3.3	3.3	3.2	3.2
DRUMS	19.5	19.3	19.0	18.8	18.6	18.5
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 40.0 KW ARRAY WIDTH = 7.00 M

BLANKET AREA = .44444+06 IN*SQ BLANKET WEIGHT = 244.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.019	.030	.039	.048	.057
***** TORSIONAL FREQUENCY HZ *****	.011	.019	.030	.039	.048	.057
***** BENDING FREQUENCY HZ *****	.021	.036	.058	.076	.096	.115
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	120.7	119.4	117.9	116.9	115.9	115.1
ARRAY LENGTH (M)	46.76	47.26	47.86	48.28	48.70	49.06
ASPECT RATIO	6.68	6.75	6.84	6.90	6.96	7.01
ARRAY MASS (KG)	150.5	157.8	169.3	179.5	191.1	203.6
ARRAY WEIGHT (LB)	331.1	347.1	372.5	395.0	420.4	447.9
CENTER OF GRAVITY (IN)	750.6	745.8	734.9	725.2	715.2	700.7
TENSION PER BLANKET (LB)	1.00	3.00	8.00	14.00	22.50	32.50
MOMENT OF INERTIA I1	.3124+09	.3290+09	.3527+09	.3727+09	.3953+09	.4165+09
MOMENT OF INERTIA I2	.1752+07	.1714+07	.1671+07	.1643+07	.1617+07	.1595+07
SPECIFIC POWER (KW/KG)	.266	.254	.236	.223	.209	.196
SPECIFIC WEIGHT (KG/KW)	3.8	3.9	4.2	4.5	4.8	5.1
BLANKET - MAST CLEARANCE (IN)	12.9	12.9	12.7	12.6	12.6	12.4
* BOOM PROPERTIES *						
DIAMETER (IN)	8.33	11.03	14.29	16.50	18.66	20.69
EI (LB-IN-SQ)	.98103+06	.30070+07	.82228+07	.14645+08	.23942+08	.35098+08
ROOT SPRING (LB-IN/RAD)	.2272+05	.5264+05	.1119+06	.1726+06	.2495+06	.3324+06
BUCKLING CAPABILITY RATIO	46.43	27.09	17.06	13.01	10.35	8.81
STRENGTH CAPABILITY RATIO	.78	1.73	3.56	5.25	7.23	9.44
* CANNISTER PROPERTIES *						
HEIGHT (IN)	36.25	39.66	43.27	46.06	48.78	50.77
DIAMETER (IN)	9.83	13.01	16.86	19.48	22.02	24.41
* WEIGHTS (LB) *						
ARRAY	331.1	347.1	372.5	395.0	420.4	447.9
BOOM	9.4	16.7	27.5	37.1	47.8	57.5
CANNISTER	10.2	17.9	30.0	40.0	51.2	62.8
TENSION MECHANISM	1.4	1.9	3.4	5.4	7.8	10.2
MAST SLEEVE	4.1	5.0	6.2	7.0	7.7	8.5
SHAFT	7.2	7.1	6.9	6.8	6.7	9.1
HEADER	2.6	2.8	3.1	3.5	4.1	4.8
DRUM BEARING	1.5	1.6	1.7	1.9	2.1	2.4
CENTER SUPPORT	14.3	14.1	13.9	13.7	13.6	13.5
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	9.7	9.7	9.7	9.7	9.7	9.7
LEADING EDGE MEMBERS	3.7	3.7	3.6	3.6	3.5	3.5
DRUMS	21.2	21.0	20.7	20.6	20.4	20.3
LATCHES	.3	.3	.3	.3	.3	.3

ORIGINAL PAGE IS
OF POOR QUALITY

ARRAY TYPE GE ROLLOUT   POWER/WING = 40.0 KW   ARRAY WIDTH = 7.50 M

BLANKET AREA = .44444+06 IN=SQ   BLANKET WEIGHT = 244.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.019	.031	.040	.051	.060
***** TORSIONAL FREQUENCY HZ *****	.011	.019	.031	.040	.051	.060
***** BENDING FREQUENCY HZ *****	.022	.037	.060	.080	.101	.120
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	130.8	129.5	128.1	127.1	126.2	125.4
ARRAY LENGTH (M)	43.17	43.58	44.06	44.40	44.73	45.02
ASPECT RATIO	5.76	5.81	5.87	5.92	5.96	6.00
ARRAY MASS (KG)	151.6	158.0	168.2	177.3	187.7	199.3
ARRAY WEIGHT (LB)	333.4	347.6	370.0	390.0	413.0	438.4
CENTER OF GRAVITY (IN)	685.9	682.1	674.2	666.5	656.4	644.4
TENSION PER BLANKET (LB)	1.00	3.00	8.00	14.00	22.50	32.50
MOMENT OF INERTIA I1	.2657+09	.2782+09	.2963+09	.3115+09	.3280+09	.3448+09
MOMENT OF INERTIA I2	.2071+07	.2031+07	.1987+07	.1956+07	.1931+07	.1909+07
SPECIFIC POWER (KW/KG)	.264	.253	.238	.226	.213	.201
SPECIFIC WEIGHT (KG/KW)	3.8	3.9	4.2	4.4	4.7	5.0
BLANKET - MAST CLEARANCE (IN)	12.9	12.9	12.8	12.8	12.6	12.6
* BOOM PROPERTIES *						
DIAMETER (IN)	7.89	10.43	13.40	15.47	17.62	19.38
EI (LB-IN-SQ)	.83615+06	.25562+07	.69684+07	.12383+08	.20201+08	.29560+08
ROOT SPRING (LB-IN/RAD)	.2016+05	.4660+05	.9887+05	.1522+06	.2197+06	.2922+06
BUCKLING CAPABILITY RATIO	41.57	24.23	15.00	11.43	9.22	7.72
STRENGTH CAPABILITY RATIO	.72	1.60	3.22	4.76	6.75	8.61
* CANNISTER PROPERTIES *						
HEIGHT (IN)	34.57	37.79	41.57	44.20	46.38	48.61
DIAMETER (IN)	9.31	12.30	15.81	18.25	20.79	22.86
* WEIGHTS (LB) *						
ARRAY	333.4	347.6	370.0	390.0	413.0	438.4
BOOM	8.3	14.6	24.4	32.8	41.6	50.6
CANNISTER	9.2	16.0	26.5	35.3	45.7	55.3
TENSION MECHANISM	1.3	1.8	3.2	5.1	7.3	9.5
MAST SLEEVE	3.7	4.5	5.5	6.1	6.9	7.5
SHAFT	8.5	8.3	8.2	8.0	8.4	11.5
HEADER	2.6	2.8	3.2	3.7	4.4	5.2
DRUM BEARING	1.5	1.6	1.7	1.9	2.1	2.4
CENTER SUPPORT	16.0	15.8	15.5	15.4	15.2	15.1
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	9.7	9.7	9.7	9.7	9.7	9.7
LEADING EDGE MEMBERS	4.0	4.0	3.9	3.9	3.9	3.8
DRUMS	22.9	22.7	22.5	22.3	22.1	22.0
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 40.0 KW ARRAY WIDTH = 8.00 M

BLANKET AREA = .44444+06 IN=SQ BLANKET WEIGHT = 244.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.012	.020	.032	.042	.053	.062
***** TORSIONAL FREQUENCY HZ *****	.012	.020	.032	.042	.053	.062
***** BENDING FREQUENCY HZ *****	.022	.039	.063	.083	.105	.125
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	141.7	139.6	138.3	137.3	136.4	135.6
ARRAY LENGTH (M)	39.82	40.43	40.83	41.10	41.37	41.61
ASPECT RATIO	4.98	5.05	5.10	5.14	5.17	5.20
ARRAY MASS (KG)	153.1	158.7	167.8	176.0	185.6	196.5
ARRAY WEIGHT (LB)	336.8	349.1	369.2	387.1	408.4	432.4
CENTER OF GRAVITY (IN)	625.2	627.0	620.7	614.5	606.5	595.2
TENSION PER BLANKET (LB)	1.00	3.00	8.00	14.00	22.50	32.50
MOMENT OF INERTIA I1	.2259+09	.2386+09	.2526+09	.2644+09	.2778+09	.2911+09
MOMENT OF INERTIA I2	.2453+07	.2378+07	.2332+07	.2302+07	.2275+07	.2253+07
SPECIFIC POWER (KW/KG)	.261	.252	.238	.227	.215	.204
SPECIFIC WEIGHT (KG/KW)	3.8	4.0	4.2	4.4	4.6	4.9
BLANKET - MAST CLEARANCE (IN)	12.0	12.9	12.9	12.8	12.8	12.7
* BOOM PROPERTIES *						
DIAMETER (IN)	7.40	9.89	12.70	14.66	16.56	18.20
EI (LB-IN-SQ)	.71166+06	.22003+07	.59830+07	.10613+08	.17283+08	.25251+08
ROOT SPRING (LB-IN/RAD)	.1786+05	.4165+05	.8819+05	.1356+06	.1954+06	.2597+06
BUCKLING CAPABILITY RATIO	36.60	21.79	13.48	10.26	8.14	6.81
STRENGTH CAPABILITY RATIO	.64	1.48	2.99	4.42	6.13	7.83
* CANNISTER PROPERTIES *						
HEIGHT (IN)	33.34	36.23	39.82	42.32	44.75	46.85
DIAMETER (IN)	8.73	11.67	14.98	17.29	19.54	21.48
* WEIGHTS (LB) *						
ARRAY	336.8	349.1	369.2	387.1	408.4	432.4
BOOM	7.4	13.0	21.6	29.0	37.3	45.3
CANNISTER	8.1	14.5	23.8	31.7	40.5	49.0
TENSION MECHANISM	1.3	1.8	3.1	4.8	6.9	9.0
MAST SLEEVE	3.3	4.0	4.9	5.5	6.1	6.6
SHAFT	10.0	9.7	9.5	9.4	10.4	14.3
HEADER	2.7	2.9	3.3	3.9	4.7	5.6
DRUM BEARING	1.5	1.6	1.7	1.9	2.1	2.4
CENTER SUPPORT	18.0	17.6	17.3	17.1	17.0	16.8
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	9.7	9.7	9.7	9.7	9.7	9.7
LEADING EDGE MEMBERS	4.3	4.3	4.2	4.2	4.2	4.1
DRUMS	24.8	24.4	24.2	24.0	23.9	23.7
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT　　POWER/WING = 40.0 KW　　ARRAY WIDTH = 8.50 M

BLANKET AREA = .44444+06 IN-SQ　　BLANKET WEIGHT = 244.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.012	.021	.033	.044	.055	.065
***** TORSIONAL FREQUENCY HZ *****	.012	.021	.033	.044	.055	.065
***** BENDING FREQUENCY HZ *****	.023	.040	.065	.086	.108	.130
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	150.6	150.6	148.4	147.5	146.6	145.9
ARRAY LENGTH (M)	37.48	37.48	38.04	38.27	38.49	38.69
ASPECT RATIO	4.41	4.41	4.48	4.50	4.53	4.55
ARRAY MASS (KG)	154.5	159.9	168.0	175.4	184.6	195.2
ARRAY WEIGHT (LB)	340.0	351.7	369.7	385.9	406.2	429.4
CENTER OF GRAVITY (IN)	582.1	575.0	574.0	569.0	561.4	550.5
TENSION PER BLANKET (LB)	1.00	3.00	8.00	14.00	22.50	32.50
MOMENT OF INERTIA I1	.2001+09	.2047+09	.2182+09	.2277+09	.2385+09	.2492+09
MOMENT OF INERTIA I2	.2788+07	.2789+07	.2707+07	.2676+07	.2649+07	.2628+07
SPECIFIC POWER (KW/KG)	.259	.250	.238	.228	.217	.205
SPECIFIC WEIGHT (KG/KW)	3.9	4.0	4.2	4.4	4.6	4.9
BLANKET - MAST CLEARANCE (IN)	13.2	12.1	12.9	12.9	12.8	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	7.07	9.30	12.07	13.92	15.72	17.28
EI (LB-IN-SQ)	.63040+06	.18912+07	.51945+07	.92006+07	.14961+08	.21830+08
ROOT SPRING (LB-IN/RAD)	.1631+05	.3718+05	.7932+05	.1218+06	.1754+06	.2328+06
BUCKLING CAPABILITY RATIO	33.37	19.27	12.17	9.25	7.34	6.14
STRENGTH CAPABILITY RATIO	.60	1.33	2.77	4.11	5.70	7.30
* CANNISTER PROPERTIES *						
HEIGHT (IN)	32.39	35.11	38.34	40.73	43.05	45.06
DIAMETER (IN)	8.34	10.97	14.24	16.43	18.55	20.39
* WEIGHTS (LB) *						
ARRAY	340.0	351.7	369.7	385.9	406.2	429.4
BOOM	6.8	11.7	19.4	26.0	33.3	40.4
CANNISTER	7.4	12.8	21.6	28.7	36.6	44.2
TENSION MECHANISM	1.2	1.7	2.9	4.6	6.5	8.5
MAST SLEEVE	3.0	3.6	4.4	5.0	5.5	6.0
SHAFT	11.4	11.4	11.0	10.9	12.6	17.6
HEADER	2.7	2.9	3.5	4.1	5.1	6.1
DRUM BEARING	1.5	1.6	1.7	1.9	2.1	2.4
CENTER SUPPORT	19.7	19.7	19.2	19.1	18.9	18.8
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	9.7	9.7	9.7	9.7	9.7	9.7
LEADING EDGE MEMBERS	4.6	4.6	4.5	4.5	4.5	4.5
DRUMS	26.3	26.3	25.9	25.7	25.6	25.5
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 40.0 KW   ARRAY WIDTH = 9.00 M

BLANKET AREA = .44444+06 IN-SQ   BLANKET WEIGHT = 244.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.013	.021	.035	.045	.057	.067
***** TORSIONAL FREQUENCY HZ *****	.013	.021	.035	.045	.057	.067
***** BENDING FREQUENCY HZ *****	.024	.041	.067	.089	.112	.134
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	160.8	159.4	158.4	157.6	156.7	156.0
ARRAY LENGTH (M)	35.11	35.40	35.63	35.82	36.01	36.17
ASPECT RATIO	3.90	3.93	3.96	3.98	4.00	4.02
ARRAY MASS (KG)	156.5	161.2	168.7	175.5	184.5	194.9
ARRAY WEIGHT (LB)	344.3	354.5	371.2	386.1	405.9	428.8
CENTER OF GRAVITY (IN)	537.9	537.4	532.8	529.0	521.5	510.9
TENSION PER BLANKET (LB)	1.00	3.00	8.00	14.00	22.50	32.50
MOMENT OF INERTIA I1	.1756+09	.1823+09	.1908+09	.1986+09	.2075+09	.2165+09
MOMENT OF INERTIA I2	.3201+07	.3148+07	.3109+07	.3078+07	.3051+07	.3030+07
SPECIFIC POWER (KW/KG)	.256	.248	.237	.228	.217	.205
SPECIFIC WEIGHT (KG/KW)	3.9	4.0	4.2	4.4	4.6	4.9
BLANKET - MAST CLEARANCE (IN)	13.0	13.2	13.0	13.0	12.9	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	6.78	8.96	11.49	13.25	14.96	16.44
EI (LB-IN-SQ)	.55317+06	.16869+07	.45560+07	.80603+07	.13091+08	.19083+08
ROOT SPRING (LB-IN/RAD)	.1479+05	.3412+05	.7189+05	.1103+06	.1587+06	.2105+06
BUCKLING CAPABILITY RATIO	30.76	17.91	11.04	8.39	6.65	5.56
STRENGTH CAPABILITY RATIO	.56	1.26	2.57	3.81	5.29	6.78
* CANNISTER PROPERTIES *						
HEIGHT (IN)	30.97	33.84	37.10	39.40	41.62	43.55
DIAMETER (IN)	8.00	10.58	13.56	15.64	17.66	19.40
* WEIGHTS (LB) *						
ARRAY	344.3	354.5	371.2	386.1	405.9	428.8
BOOM	6.0	10.6	17.6	23.5	30.1	36.5
CANNISTER	6.8	12.0	19.6	26.1	33.3	40.2
TENSION MECHANISM	1.2	1.7	2.8	4.4	6.2	8.1
MAST SLEEVE	2.8	3.4	4.1	4.5	5.0	5.4
SHAFT	13.0	12.8	12.7	12.5	15.2	21.3
HEADER	2.7	2.9	3.6	4.4	5.4	6.6
DRUM BEARING	1.5	1.6	1.7	1.9	2.1	2.4
CENTER SUPPORT	21.8	21.5	21.3	21.1	20.9	20.8
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	9.7	9.7	9.7	9.7	9.7	9.7
LEADING EDGE MEMBERS	4.9	4.9	4.8	4.8	4.8	4.8
DRUMS	28.0	27.8	27.6	27.5	27.3	27.2
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 45.0 KW   ARRAY WIDTH = 6.00 M

BLANKET AREA = .50000+06 IN-SQ   BLANKET WEIGHT = 274.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.009	.017	.026	.033	.041	.051
***** TORSIONAL FREQUENCY HZ *****	.009	.017	.026	.033	.041	.051
***** BENDING FREQUENCY HZ *****	.017	.033	.052	.066	.084	.107
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	100.1	98.0	96.2	95.0	92.0	90.7
ARRAY LENGTH (M)	63.43	64.77	65.99	66.81	68.55	70.00
ASPECT RATIO	10.57	10.79	11.00	11.14	11.42	11.67
ARRAY MASS (KG)	167.1	183.2	203.1	219.3	242.0	274.8
ARRAY WEIGHT (LB)	367.7	403.1	446.9	482.5	532.5	604.6
CENTER OF GRAVITY (IN)	1042.1	1026.8	1006.8	989.6	979.5	955.5
TENSION PER BLANKET (LB)	1.00	4.00	10.00	16.50	27.00	45.00
MOMENT OF INERTIA I1	.6502+09	.7174+09	.7952+09	.8550+09	.9594+09	.1087+10
MOMENT OF INERTIA I2	.1323+07	.1268+07	.1221+07	.1192+07	.1133+07	.1089+07
SPECIFIC POWER (KW/KG)	.269	.246	.222	.205	.186	.164
SPECIFIC WEIGHT (KG/KW)	3.7	4.1	4.5	4.9	5.4	6.1
BLANKET - MAST CLEARANCE (IN)	12.8	12.6	12.3	12.1	12.8	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	10.44	15.03	19.07	21.90	25.27	29.01
EI (LB-IN-SQ)	.18052+07	.75286+07	.19540+08	.33049+08	.56925+08	.98927+08
ROOT SPRING (LB-IN/RAD)	.3590+05	.1048+06	.2142+06	.3178+06	.4778+06	.7231+06
BUCKLING CAPABILITY RATIO	72.88	37.73	24.32	19.44	15.81	12.50
STRENGTH CAPABILITY RATIO	.99	2.74	5.16	7.36	10.34	14.13
* CANNISTER PROPERTIES *						
HEIGHT (IN)	42.65	47.83	52.86	55.81	59.74	64.49
DIAMETER (IN)	12.32	17.73	22.51	25.84	29.81	34.23
* WEIGHTS (LB) *						
ARRAY	367.7	403.1	446.9	482.5	532.5	604.6
BOOM	15.0	30.8	50.6	65.7	87.3	117.5
CANNISTER	15.9	32.9	52.9	69.8	92.8	122.3
TENSION MECHANISM	1.6	2.8	5.1	7.4	11.3	19.3
MAST SLEEVE	6.2	8.4	10.3	11.7	13.5	15.6
SHAFT	5.5	5.3	5.1	5.0	4.7	6.5
HEADER	2.6	2.8	3.0	3.3	3.8	4.5
DRUM BEARING	1.5	1.6	1.8	2.0	2.3	2.8
CENTER SUPPORT	12.1	11.8	11.6	11.4	11.1	10.9
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	10.2	10.2	10.2	10.2	10.2	10.2
LEADING EDGE MEMBERS	3.1	3.0	2.9	2.9	2.8	2.8
DRUMS	17.8	17.5	17.2	17.0	16.5	16.2
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT　　POWER/WING = 45.0 KW　　ARRAY WIDTH = 6.50 M

BLANKET AREA = .50000+06 IN-SQ　　BLANKET WEIGHT = 274.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.009	.018	.028	.035	.044	.055
***** TORSIONAL FREQUENCY HZ *****	.009	.018	.028	.035	.044	.055
***** BENDING FREQUENCY HZ *****	.018	.035	.055	.070	.089	.113
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	110.3	108.3	106.6	105.5	104.2	101.7
ARRAY LENGTH (M)	57.59	58.63	59.57	60.20	60.91	62.44
ASPECT RATIO	8.86	9.02	9.16	9.26	9.37	9.61
ARRAY MASS (KG)	167.0	180.8	197.9	211.6	229.9	258.8
ARRAY WEIGHT (LB)	367.4	397.8	435.3	465.6	505.7	569.3
CENTER OF GRAVITY (IN)	940.0	928.9	911.3	898.8	880.8	863.9
TENSION PER BLANKET (LB)	1.00	4.00	10.00	16.50	27.00	45.00
MOMENT OF INERTIA I1	.5328+09	.5805+09	.6338+09	.6763+09	.7296+09	.8273+09
MOMENT OF INERTIA I2	.1615+07	.1558+07	.1509+07	.1478+07	.1445+07	.1379+07
SPECIFIC POWER (KW/KG)	.269	.249	.227	.213	.196	.174
SPECIFIC WEIGHT (KG/KW)	3.7	4.0	4.4	4.7	5.1	5.8
BLANKET - MAST CLEARANCE (IN)	12.8	12.7	12.5	12.4	12.1	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	9.74	13.90	17.74	20.21	23.16	26.64
EI (LB-IN-SQ)	.14884+07	.61692+07	.15922+08	.26828+08	.44952+08	.78716+08
ROOT SPRING (LB-IN/RAD)	.3106+05	.9024+05	.1837+06	.2718+06	.4002+06	.6092+06
BUCKLING CAPABILITY RATIO	63.41	32.27	21.04	16.55	13.28	10.54
STRENGTH CAPABILITY RATIO	.89	2.43	4.71	6.60	9.33	12.86
* CANNISTER PROPERTIES *						
HEIGHT (IN)	40.39	45.56	49.80	52.87	55.95	60.56
DIAMETER (IN)	11.49	16.40	20.93	23.85	27.33	31.44
* WEIGHTS (LB) *						
ARRAY	367.4	397.8	435.3	465.6	505.7	569.3
BOOM	12.9	26.8	43.0	56.5	72.9	98.9
CANNISTER	13.8	28.2	45.9	59.6	78.2	103.5
TENSION MECHANISM	1.5	2.6	4.7	6.8	10.2	17.5
MAST SLEEVE	5.4	7.2	8.9	10.0	11.3	13.0
SHAFT	6.7	6.5	6.2	6.1	6.0	8.7
HEADER	2.6	2.8	3.1	3.5	4.1	5.0
DRUM BEARING	1.5	1.6	1.8	2.0	2.3	2.8
CENTER SUPPORT	13.7	13.4	13.1	12.9	12.7	12.4
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	10.2	10.2	10.2	10.2	10.2	10.2
LEADING EDGE MEMBERS	3.4	3.3	3.3	3.2	3.2	3.1
DRUMS	19.5	19.2	18.9	18.7	18.5	18.1
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 45.0 KW   ARRAY WIDTH = 7.00 M

BLANKET AREA = .50000+06 IN=SQ   BLANKET WEIGHT = 274.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.029	.037	.046	.059
***** TORSIONAL FREQUENCY HZ *****	.010	.019	.029	.037	.046	.059
***** BENDING FREQUENCY HZ *****	.018	.037	.057	.073	.093	.120
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	120.3	118.5	116.9	115.8	114.6	113.2
ARRAY LENGTH (M)	52.77	53.59	54.34	54.83	55.40	56.07
ASPECT RATIO	7.54	7.66	7.76	7.83	7.91	8.01
ARRAY MASS (KG)	167.5	179.5	194.4	206.4	222.4	247.1
ARRAY WEIGHT (LB)	368.5	395.0	427.6	454.0	489.2	543.6
CENTER OF GRAVITY (IN)	854.4	845.8	831.6	821.3	807.6	781.1
TENSION PER BLANKET (LB)	1.00	4.00	10.00	16.50	27.00	45.00
MOMENT OF INERTIA I1	.4455+09	.4803+09	.5190+09	.5497+09	.5896+09	.6432+09
MOMENT OF INERTIA I2	.1937+07	.1877+07	.1826+07	.1794+07	.1760+07	.1723+07
SPECIFIC POWER (KW/KG)	.269	.251	.231	.218	.202	.182
SPECIFIC WEIGHT (KG/KW)	3.7	4.0	4.3	4.6	4.9	5.5
BLANKET - MAST CLEARANCE (IN)	12.9	12.8	12.6	12.5	12.4	12.2
* BOOM PROPERTIES *						
DIAMETER (IN)	9.12	13.00	16.58	18.88	21.46	24.71
EI (LB-IN-SQ)	.12495+07	.51549+07	.13248+08	.22260+08	.37178+08	.63487+08
ROOT SPRING (LB-IN/RAD)	.2724+05	.7887+05	.1601+06	.2362+06	.3471+06	.5185+06
BUCKLING CAPABILITY RATIO	55.62	28.24	18.38	14.44	11.40	9.07
STRENGTH CAPABILITY RATIO	.81	2.20	4.29	6.03	8.36	11.88
* CANNISTER PROPERTIES *						
HEIGHT (IN)	38.59	43.43	47.36	50.21	53.42	56.87
DIAMETER (IN)	10.76	15.34	19.56	22.28	25.32	29.16
* WEIGHTS (LB) *						
ARRAY	368.5	395.0	427.6	454.0	489.2	543.6
BOOM	11.3	23.4	37.4	48.9	63.9	83.3
CANNISTER	12.2	24.7	40.2	52.1	67.4	89.2
TENSION MECHANISM	1.4	2.4	4.4	6.3	9.5	15.9
MAST SLEEVE	4.8	6.3	7.7	8.7	9.7	11.1
SHAFT	8.0	7.8	7.5	7.4	7.6	11.7
HEADER	2.6	2.8	3.3	3.7	4.4	5.5
DRUM BEARING	1.5	1.6	1.8	2.0	2.3	2.8
CENTER SUPPORT	15.3	15.0	14.7	14.6	14.4	14.1
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	10.2	10.2	10.2	10.2	10.2	10.2
LEADING EDGE MEMBERS	3.7	3.6	3.6	3.5	3.5	3.5
DRUMS	21.2	20.9	20.7	20.5	20.3	20.0
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 45.0 KW ARRAY WIDTH = 7.50 M

BLANKET AREA = .50000+06 IN=SQ BLANKET WEIGHT = 274.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.020	.031	.039	.049	.062
***** TORSIONAL FREQUENCY HZ *****	.010	.020	.031	.039	.049	.062
***** BENDING FREQUENCY HZ *****	.019	.038	.060	.077	.097	.125
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	130.4	128.6	127.1	126.1	125.0	123.6
ARRAY LENGTH (M)	48.70	49.36	49.96	50.36	50.82	51.36
ASPECT RATIO	6.49	6.58	6.66	6.72	6.78	6.85
ARRAY MASS (KG)	168.4	179.1	192.2	202.8	217.2	239.9
ARRAY WEIGHT (LB)	370.6	394.0	422.8	446.1	477.9	527.7
CENTER OF GRAVITY (IN)	781.2	774.0	763.5	755.2	741.2	718.4
TENSION PER BLANKET (LB)	1.00	4.00	10.00	16.50	27.00	45.00
MOMENT OF INERTIA I1	.3784+09	.4043+09	.4338+09	.4569+09	.4859+09	.5273+09
MOMENT OF INERTIA I2	.2290+07	.2228+07	.2175+07	.2141+07	.2106+07	.2069+07
SPECIFIC POWER (KW/KG)	.267	.251	.234	.222	.207	.188
SPECIFIC WEIGHT (KG/KW)	3.7	4.0	4.3	4.5	4.8	5.3
BLANKET = MAST CLEARANCE (IN)	13.0	12.9	12.8	12.7	12.5	12.4
* BOOM PROPERTIES *						
DIAMETER (IN)	8.57	12.29	15.55	17.70	20.25	23.13
EI (LB=IN=SQ)	.10642+07	.43737+07	.11202+08	.18779+08	.31284+08	.53257+08
ROOT SPRING (LB=IN/RAD)	.2415+05	.6972+05	.1412+06	.2080+06	.3049+06	.4545+06
BUCKLING CAPABILITY RATIO	49.09	25.26	16.17	12.69	10.16	7.95
STRENGTH CAPABILITY RATIO	.73	2.04	3.90	5.50	7.84	10.92
* CANNISTER PROPERTIES *						
HEIGHT (IN)	37.15	41.32	45.38	48.06	50.69	54.27
DIAMETER (IN)	10.11	14.51	18.35	20.88	23.90	27.30
* WEIGHTS (LB) *						
ARRAY	370.6	394.0	422.8	446.1	477.9	527.7
BOOM	10.1	20.4	33.1	43.1	55.4	73.0
CANNISTER	10.8	22.2	35.5	45.9	60.1	78.4
TENSION MECHANISM	1.4	2.3	4.1	5.9	8.8	14.8
MAST SLEEVE	4.3	5.6	6.8	7.6	8.6	9.7
SHAFT	9.4	9.2	8.9	8.8	9.6	15.0
HEADER	2.6	2.9	3.4	3.9	4.7	6.1
DRUM BEARING	1.5	1.6	1.8	2.0	2.3	2.8
CENTER SUPPORT	17.2	16.8	16.5	16.4	16.2	15.9
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	10.2	10.2	10.2	10.2	10.2	10.2
LEADING EDGE MEMBERS	4.0	3.9	3.9	3.9	3.8	3.8
DRUMS	22.9	22.6	22.4	22.2	22.0	21.8
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 45.0 KW   ARRAY WIDTH = 8.00 M

BLANKET AREA = .50000+06 IN-SQ   BLANKET WEIGHT = 274.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.021	.032	.040	.051	.064
***** TORSIONAL FREQUENCY HZ *****	.010	.021	.032	.040	.051	.064
***** BENDING FREQUENCY HZ *****	.020	.040	.062	.080	.101	.130
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	140.4	138.8	137.3	136.3	135.3	134.0
ARRAY LENGTH (M)	45.22	45.76	46.26	46.58	46.95	47.39
ASPECT RATIO	5.65	5.72	5.78	5.82	5.87	5.92
ARRAY MASS (KG)	169.8	179.3	191.0	200.4	213.8	235.0
ARRAY WEIGHT (LB)	373.5	394.4	420.2	441.0	470.3	517.1
CENTER OF GRAVITY (IN)	717.6	712.6	703.4	696.6	685.2	663.7
TENSION PER BLANKET (LB)	1.00	4.00	10.00	16.50	27.00	45.00
MOMENT OF INERTIA I1	.3257+09	.3458+09	.3682+09	.3861+09	.4093+09	.4417+09
MOMENT OF INERTIA I2	.2675+07	.2610+07	.2555+07	.2521+07	.2485+07	.2448+07
SPECIFIC POWER (KW/KG)	.265	.251	.236	.225	.210	.191
SPECIFIC WEIGHT (KG/KW)	3.8	4.0	4.2	4.5	4.8	5.2
BLANKET - MAST CLEARANCE (IN)	13.0	12.9	12.8	12.8	12.7	12.6
* BOOM PROPERTIES *						
DIAMETER (IN)	8.13	11.57	14.74	16.76	19.04	21.73
EI (LB-IN-SQ)	.91744+06	.37590+07	.96003+07	.16064+08	.26704+08	.45346+08
ROOT SPRING (LB-IN/RAD)	.2161+05	.6223+05	.1257+06	.1850+06	.2708+06	.4028+06
BUCKLING CAPABILITY RATIO	44.22	22.38	14.52	11.39	8.97	7.01
STRENGTH CAPABILITY RATIO	.67	1.84	3.62	5.13	7.16	10.00
* CANNISTER PROPERTIES *						
HEIGHT (IN)	35.59	39.92	43.39	45.92	48.77	52.14
DIAMETER (IN)	9.60	13.65	17.39	19.78	22.46	25.64
* WEIGHTS (LB) *						
ARRAY	373.5	394.4	420.2	441.0	470.3	517.1
BOOM	9.0	18.4	29.2	38.0	49.4	65.0
CANNISTER	9.7	19.7	31.9	41.3	53.3	69.4
TENSION MECHANISM	1.3	2.2	3.9	5.6	8.3	13.9
MAST SLEEVE	3.9	5.0	6.1	6.8	7.6	8.6
SHAFT	11.0	10.7	10.5	10.3	12.0	18.8
HEADER	2.7	3.0	3.5	4.1	5.1	6.7
DRUM BEARING	1.5	1.6	1.8	2.0	2.3	2.8
CENTER SUPPORT	19.2	18.8	18.5	18.3	18.1	17.9
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	10.2	10.2	10.2	10.2	10.2	10.2
LEADING EDGE MEMBERS	4.3	4.2	4.2	4.2	4.1	4.1
DRUMS	24.6	24.4	24.1	23.9	23.8	23.6
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 45.0 KW ARRAY WIDTH = 8.50 M

BLANKET AREA = .50000+06 IN-SQ BLANKET WEIGHT = 274.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.021	.033	.042	.053	.067
***** TORSIONAL FREQUENCY HZ *****	.011	.021	.033	.042	.053	.067
***** BENDING FREQUENCY HZ *****	.021	.041	.064	.082	.105	.135
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	150.6	148.9	147.4	146.5	145.5	144.3
ARRAY LENGTH (M)	42.17	42.66	43.07	43.34	43.64	44.00
ASPECT RATIO	4.96	5.02	5.07	5.10	5.13	5.18
ARRAY MASS (KG)	171.5	180.0	190.6	199.1	211.8	232.2
ARRAY WEIGHT (LB)	377.2	395.9	419.2	438.0	465.9	510.7
CENTER OF GRAVITY (IN)	661.3	658.2	650.9	645.5	634.5	613.8
TENSION PER BLANKET (LB)	1.00	4.00	10.00	16.50	27.00	45.00
MOMENT OF INERTIA I1	.2829+09	.2993+09	.3170+09	.3311+09	.3497+09	.3757+09
MOMENT OF INERTIA I2	.3097+07	.3024+07	.2968+07	.2933+07	.2897+07	.2861+07
SPECIFIC POWER (KW/KG)	.262	.250	.236	.226	.213	.194
SPECIFIC WEIGHT (KG/KW)	3.8	4.0	4.2	4.4	4.7	5.2
BLANKET - MAST CLEARANCE (IN)	12.9	13.0	12.9	12.8	12.8	12.7
* BOOM PROPERTIES *						
DIAMETER (IN)	7.73	11.00	14.01	15.92	18.07	20.62
EI (LB-IN-SQ)	.79785+06	.32663+07	.83224+07	.13904+08	.23073+08	.39098+08
ROOT SPRING (LB-IN/RAD)	.1946+05	.5601+05	.1130+06	.1660+06	.2427+06	.3604+06
BUCKLING CAPABILITY RATIO	39.99	20.23	13.12	10.27	8.09	6.32
STRENGTH CAPABILITY RATIO	.62	1.71	3.37	4.78	6.68	9.35
* CANNISTER PROPERTIES *						
HEIGHT (IN)	34.25	38.41	41.70	44.11	46.82	50.02
DIAMETER (IN)	9.13	12.98	16.53	18.79	21.33	24.33
* WEIGHTS (LB) *						
ARRAY	377.2	395.9	419.2	438.0	465.9	510.7
BOOM	8.0	16.4	26.1	33.9	44.0	57.8
CANNISTER	8.8	17.9	28.9	37.4	48.1	62.7
TENSION MECHANISM	1.3	2.1	3.7	5.3	7.9	13.1
MAST SLEEVE	3.5	4.6	5.5	6.2	6.9	7.7
SHAFT	12.7	12.4	12.1	12.0	14.7	23.2
HEADER	2.7	3.0	3.7	4.4	5.5	7.4
DRUM BEARING	1.5	1.6	1.8	2.0	2.3	2.8
CENTER SUPPORT	21.3	21.0	20.6	20.4	20.2	20.0
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	10.2	10.2	10.2	10.2	10.2	10.2
LEADING EDGE MEMBERS	4.6	4.6	4.5	4.5	4.5	4.4
DRUMS	26.4	26.1	25.8	25.7	25.5	25.3
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 45.0 KW   ARRAY WIDTH = 9.00 M

BLANKET AREA = .50000+06 IN=SQ   BLANKET WEIGHT = 274.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.022	.034	.043	.055	.069
***** TORSIONAL FREQUENCY HZ *****	.011	.022	.034	.043	.055	.069
***** BENDING FREQUENCY HZ *****	.021	.042	.067	.085	.109	.140
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	160.5	159.4	157.6	156.7	155.7	154.6
ARRAY LENGTH (M)	39.57	39.82	40.30	40.52	40.78	41.08
ASPECT RATIO	4.40	4.42	4.48	4.50	4.53	4.56
ARRAY MASS (KG)	173.4	181.2	190.8	198.6	210.9	230.8
ARRAY WEIGHT (LB)	381.5	398.6	419.7	436.9	463.9	507.8
CENTER OF GRAVITY (IN)	612.9	607.8	604.5	600.3	589.4	569.3
TENSION PER BLANKET (LB)	1.00	4.00	10.00	16.50	27.00	45.00
MOMENT OF INERTIA I1	.2491+09	.2601+09	.2761+09	.2877+09	.3029+09	.3244+09
MOMENT OF INERTIA I2	.3539+07	.3495+07	.3413+07	.3378+07	.3343+07	.3308+07
SPECIFIC POWER (KW/KG)	.260	.248	.236	.227	.213	.195
SPECIFIC WEIGHT (KG/KW)	3.9	4.0	4.2	4.4	4.7	5.1
BLANKET - MAST CLEARANCE (IN)	13.0	12.5	12.9	12.9	12.8	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	7.38	10.46	13.34	15.16	17.20	19.62
EI (LB-IN-SQ)	.70267+06	.28466+07	.72858+07	.12157+08	.20143+08	.34073+08
ROOT SPRING (LB-IN/RAD)	.1769+05	.5052+05	.1022+06	.1501+06	.2192+06	.3251+06
BUCKLING CAPABILITY RATIO	36.37	18.30	11.90	9.31	7.33	5.72
STRENGTH CAPABILITY RATIO	.57	1.58	3.13	4.44	6.23	8.73
* CANNISTER PROPERTIES *						
HEIGHT (IN)	33.16	37.03	40.26	42.57	45.15	48.22
DIAMETER (IN)	8.70	12.35	15.74	17.89	20.30	23.15
* WEIGHTS (LB) *						
ARRAY	381.5	398.6	419.7	436.9	463.9	507.8
BOOM	7.3	14.8	23.6	30.6	39.6	51.9
CANNISTER	8.1	16.2	26.3	34.0	43.7	56.9
TENSION MECHANISM	1.3	2.0	3.6	5.0	7.5	12.4
MAST SLEEVE	3.3	4.2	5.0	5.6	6.2	7.0
SHAFT	14.5	14.3	13.9	13.8	17.8	28.3
HEADER	2.7	3.1	3.8	4.6	5.9	8.1
DRUM BEARING	1.5	1.6	1.8	2.0	2.3	2.8
CENTER SUPPORT	23.6	23.4	22.9	22.7	22.5	22.2
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	10.2	10.2	10.2	10.2	10.2	10.2
LEADING EDGE MEMBERS	4.9	4.9	4.8	4.8	4.8	4.7
DRUMS	28.0	27.9	27.6	27.4	27.2	27.0
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GF ROLLOUT   POWER/WING = 50.0 KW   ARRAY WIDTH = 7.00 M

BLANKET AREA = .55556+06 IN-SQ   BLANKET WEIGHT = 305.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.027	.035	.045	.052	.055
***** TORSIONAL FREQUENCY HZ *****	.011	.027	.035	.045	.052	.055
***** BENDING FREQUENCY HZ *****	.020	.053	.070	.091	.107	.112
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	119.5	116.1	114.8	113.4	111.3	111.0
ARRAY LENGTH (M)	59.05	60.75	61.44	62.24	63.37	63.59
ASPECT RATIO	8.44	8.68	8.78	8.89	9.05	9.08
ARRAY MASS (KG)	187.7	217.4	234.5	257.3	278.4	285.0
ARRAY WEIGHT (LB)	413.0	478.2	515.8	566.0	612.6	626.9
CENTER OF GRAVITY (IN)	956.5	930.7	915.0	896.7	883.8	880.4
TENSION PER BLANKET (LB)	1.50	10.50	18.50	32.00	45.00	50.00
MOMENT OF INERTIA I1	.6243+09	.7247+09	.7784+09	.8495+09	.9242+09	.9460+09
MOMENT OF INERTIA I2	.2103+07	.1987+07	.1943+07	.1897+07	.1833+07	.1821+07
SPECIFIC POWER (KW/KG)	.266	.230	.213	.194	.180	.175
SPECIFIC WEIGHT (KG/KW)	3.8	4.3	4.7	5.1	5.6	5.7
BLANKET - MAST CLEARANCE (IN)	12.8	12.5	12.4	12.2	12.9	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	10.99	18.26	21.16	24.43	27.03	27.80
EI (LB-IN-SQ)	.23472+07	.17387+08	.31339+08	.55617+08	.81084+08	.90710+08
ROOT SPRING (LB-IN/RAD)	.4372+05	.1963+06	.3053+06	.4695+06	.6229+06	.6776+06
BUCKLING CAPABILITY RATIO	53.85	21.24	16.18	12.46	10.85	10.33
STRENGTH CAPABILITY RATIO	1.12	4.58	6.71	9.60	12.20	13.02
* CANNISTER PROPERTIES *						
HEIGHT (IN)	42.05	50.45	54.00	58.01	60.87	61.82
DIAMETER (IN)	12.97	21.55	24.97	28.82	31.90	32.80
* WEIGHTS (LB) *						
ARRAY	413.0	478.2	515.8	566.0	612.6	626.9
BOOM	16.4	45.2	61.4	82.9	100.4	106.6
CANNISTER	17.6	48.6	65.3	87.0	106.4	112.5
TENSION MECHANISM	1.7	4.8	8.2	12.4	17.7	18.0
MAST SLEEVE	6.1	9.2	10.6	12.1	13.4	13.8
SHAFT	8.7	8.2	8.0	8.6	11.2	12.2
HEADER	2.7	3.3	3.8	4.7	5.4	5.7
DRUM BEARING	1.5	1.8	2.0	2.4	2.8	2.9
CENTER SUPPORT	16.2	15.6	15.4	15.1	14.7	14.7
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	10.6	10.6	10.6	10.6	10.6	10.6
LEADING EDGE MEMBERS	3.7	3.6	3.5	3.5	3.4	3.4
DRUMS	21.2	20.6	20.4	20.2	19.8	19.7
LATCHES	.3	.3	.3	.3	.3	.3

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE GE ROLLOUT   POWER/WING = 50.0 KW   ARRAY WIDTH = 7.50 M

BLANKET AREA = .55556+06 IN-SQ   BLANKET WEIGHT = 305.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.028	.037	.047	.055	.058
***** TORSIONAL FREQUENCY HZ *****	.011	.028	.037	.047	.055	.058
***** BENDING FREQUENCY HZ *****	.021	.055	.073	.095	.112	.118
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	129.6	126.4	125.1	123.8	122.8	122.5
ARRAY LENGTH (M)	54.45	55.82	56.38	57.01	57.46	57.61
ASPECT RATIO	7.26	7.44	7.52	7.60	7.66	7.68
ARRAY MASS (KG)	188.2	214.3	229.4	249.8	268.1	273.9
ARRAY WEIGHT (LB)	414.0	471.5	504.6	549.6	589.9	602.7
CENTER OF GRAVITY (IN)	875.1	854.7	841.8	825.1	805.6	801.8
TENSION PER BLANKET (LB)	1.50	10.50	18.50	32.00	45.00	50.00
MOMENT OF INERTIA I1	.5285+09	.6036+09	.6437+09	.6967+09	.7374+09	.7524+09
MOMENT OF INERTIA I2	.2489+07	.2368+07	.2323+07	.2275+07	.2245+07	.2235+07
SPECIFIC POWER (KW/KG)	.266	.233	.218	.200	.186	.183
SPECIFIC WEIGHT (KG/KW)	3.8	4.3	4.6	5.0	5.4	5.5
BLANKET - MAST CLEARANCE (IN)	12.9	12.7	12.6	12.4	12.3	12.2
* BOOM PROPERTIES *						
DIAMETER (IN)	10.33	17.14	19.84	22.88	25.20	25.90
EI (LB-IN-SQ)	.19956+07	.14679+08	.26384+08	.46670+08	.66669+08	.74460+08
ROOT SPRING (LB-IN/RAD)	.3871+05	.1729+06	.2684+06	.4116+06	.5379+06	.5843+06
BUCKLING CAPABILITY RATIO	47.55	18.69	14.22	10.94	9.43	8.97
STRENGTH CAPABILITY RATIO	1.02	4.18	6.15	8.83	11.26	12.03
* CANNISTER PROPERTIES *						
HEIGHT (IN)	40.38	48.25	51.57	55.31	57.57	58.44
DIAMETER (IN)	12.19	20.22	23.41	27.00	29.73	30.56
* WEIGHTS (LB) *						
ARRAY	414.0	471.5	504.6	549.6	589.9	602.7
BOOM	14.5	39.9	54.0	72.6	86.2	91.3
CANNISTER	15.6	42.9	57.5	76.5	92.7	97.9
TENSION MECHANISM	1.6	4.5	7.6	11.5	16.3	16.6
MAST SLEEVE	5.4	8.1	9.3	10.6	11.5	11.8
SHAFT	10.3	9.8	9.6	10.9	14.7	16.1
HEADER	2.7	3.4	4.1	5.1	6.1	6.4
DRUM BEARING	1.5	1.8	2.0	2.4	2.8	2.9
CENTER SUPPORT	18.2	17.6	17.3	17.1	16.9	16.8
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	10.6	10.6	10.6	10.6	10.6	10.6
LEADING EDGE MEMBERS	4.0	3.9	3.8	3.8	3.8	3.7
DRUMS	22.9	22.4	22.1	21.9	21.7	21.7
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT　　POWER/WING = 50.0 KW　　ARRAY WIDTH = 8.00 M

BLANKET AREA = .55556+06 IN=SQ　　BLANKET WEIGHT = 305.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.029	.038	.049	.058	.060
***** TORSIONAL FREQUENCY HZ *****	.011	.029	.038	.049	.058	.060
***** BENDING FREQUENCY HZ *****	.022	.057	.076	.099	.117	.123
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	139.6	136.6	135.4	134.1	133.2	132.9
ARRAY LENGTH (M)	50.52	51.64	52.10	52.61	52.98	53.10
ASPECT RATIO	6.32	6.46	6.51	6.58	6.62	6.64
ARRAY MASS (KG)	189.2	212.4	225.9	244.7	261.7	267.1
ARRAY WEIGHT (LB)	416.2	467.3	496.9	538.4	575.8	587.7
CENTER OF GRAVITY (IN)	804.6	788.7	778.3	761.1	744.7	741.0
TENSION PER BLANKET (LB)	1.50	10.50	18.50	32.00	45.00	50.00
MOMENT OF INERTIA I1	.4536+09	.5115+09	.5424+09	.5822+09	.6150+09	.6266+09
MOMENT OF INERTIA I2	.2909+07	.2784+07	.2738+07	.2689+07	.2659+07	.2648+07
SPECIFIC POWER (KW/KG)	.264	.235	.221	.204	.191	.187
SPECIFIC WEIGHT (KG/KW)	3.8	4.2	4.5	4.9	5.2	5.3
BLANKET = MAST CLEARANCE (IN)	13.0	12.8	12.7	12.5	12.5	12.4
* BOOM PROPERTIES *						
DIAMETER (IN)	9.73	16.12	18.66	21.66	23.67	24.33
EI (LB=IN=SQ)	.17181+07	.12565+08	.22531+08	.39749+08	.56675+08	.63258+08
ROOT SPRING (LB=IN/RAD)	.3459+05	.1539+06	.2384+06	.3649+06	.4762+06	.5171+06
BUCKLING CAPABILITY RATIO	42.21	16.55	12.58	9.80	8.32	7.91
STRENGTH CAPABILITY RATIO	.92	3.80	5.62	8.29	10.34	11.06
* CANNISTER PROPERTIES *						
HEIGHT (IN)	39.02	46.44	49.57	52.72	55.20	56.01
DIAMETER (IN)	11.48	19.03	22.02	25.56	27.93	28.71
* WEIGHTS (LB) *						
ARRAY	416.2	467.3	496.9	538.4	575.8	587.7
BOOM	13.1	35.7	48.2	63.7	76.5	81.0
CANNISTER	13.9	38.1	51.0	68.7	82.0	86.7
TENSION MECHANISM	1.6	4.2	7.2	10.8	15.2	15.5
MAST SLEEVE	4.8	7.2	8.2	9.4	10.2	10.4
SHAFT	12.0	11.4	11.2	13.7	18.5	20.3
HEADER	2.7	3.6	4.3	5.5	6.7	7.1
DRUM BEARING	1.5	1.8	2.0	2.4	2.8	2.9
CENTER SUPPORT	20.4	19.7	19.5	19.2	19.0	18.9
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	10.6	10.6	10.6	10.6	10.6	10.6
LEADING EDGE MEMBERS	4.3	4.2	4.1	4.1	4.1	4.1
DRUMS	24.6	24.1	23.9	23.7	23.5	23.5
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 50.0 KW   ARRAY WIDTH = 8.50 M

BLANKET AREA = .55556+06 IN-SQ   BLANKET WEIGHT = 305.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.012	.031	.040	.051	.060	.063
***** TORSIONAL FREQUENCY HZ *****	.012	.031	.040	.051	.060	.063
***** BENDING FREQUENCY HZ *****	.023	.059	.078	.103	.121	.128
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	150.6	146.8	145.7	144.4	143.5	143.2
ARRAY LENGTH (M)	46.85	48.06	48.43	48.86	49.16	49.26
ASPECT RATIO	5.51	5.65	5.70	5.75	5.78	5.80
ARRAY MASS (KG)	190.7	211.5	223.6	241.4	257.6	262.8
ARRAY WEIGHT (LB)	419.6	465.3	492.0	531.0	566.6	578.1
CENTER OF GRAVITY (IN)	737.4	730.0	721.4	706.6	689.2	685.4
TENSION PER BLANKET (LB)	1.50	10.50	18.50	32.00	45.00	50.00
MOMENT OF INERTIA I1	.3891+09	.4392+09	.4636+09	.4960+09	.5211+09	.5303+09
MOMENT OF INERTIA I2	.3405+07	.3235+07	.3188+07	.3139+07	.3109+07	.3099+07
SPECIFIC POWER (KW/KG)	.262	.236	.224	.207	.194	.190
SPECIFIC WEIGHT (KG/KW)	3.8	4.2	4.5	4.8	5.2	5.3
BLANKET - MAST CLEARANCE (IN)	12.1	12.8	12.8	12.7	12.6	12.5
* BOOM PROPERTIES *						
DIAMETER (IN)	9.23	15.32	17.72	20.41	22.47	23.09
EI (LB-IN-SQ)	.14775+07	.10881+08	.19474+08	.34279+08	.48800+08	.54440+08
ROOT SPRING (LB-IN/RAD)	.3089+05	.1381+06	.2137+06	.3266+06	.4256+06	.4620+06
BUCKLING CAPABILITY RATIO	37.98	14.95	11.35	8.71	7.50	7.13
STRENGTH CAPABILITY RATIO	.85	3.54	5.24	7.58	9.71	10.39
* CANNISTER PROPERTIES *						
HEIGHT (IN)	37.34	44.57	47.55	50.89	52.86	53.63
DIAMETER (IN)	10.89	18.08	20.91	24.09	26.51	27.25
* WEIGHTS (LB) *						
ARRAY	419.6	465.3	492.0	531.0	566.6	578.1
BOOM	11.6	31.8	42.9	57.4	67.9	71.8
CANNISTER	12.5	34.5	46.1	61.2	74.0	78.2
TENSION MECHANISM	1.5	4.0	6.8	10.1	14.3	14.6
MAST SLEEVE	4.4	6.5	7.4	8.4	9.1	9.4
SHAFT	14.0	13.3	13.1	16.8	22.9	25.2
HEADER	2.7	3.7	4.6	6.0	7.3	7.9
DRUM BEARING	1.5	1.8	2.0	2.4	2.8	2.9
CENTER SUPPORT	23.0	22.1	21.8	21.5	21.3	21.2
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	10.6	10.6	10.6	10.6	10.6	10.6
LEADING EDGE MEMBERS	4.6	4.5	4.5	4.4	4.4	4.4
DRUMS	26.5	25.8	25.6	25.4	25.3	25.2
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 50.0 KW ARRAY WIDTH = 9.00 M

BLANKET AREA = .55556+06 IN-SQ BLANKET WEIGHT = 305.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.012	.032	.041	.053	.062	.065
***** TORSIONAL FREQUENCY HZ *****	.012	.032	.041	.053	.062	.065
***** BENDING FREQUENCY HZ *****	.023	.061	.081	.106	.126	.132
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	159.4	157.0	155.9	154.7	153.8	153.5
ARRAY LENGTH (M)	44.25	44.95	45.26	45.62	45.87	45.95
ASPECT RATIO	4.92	4.99	5.03	5.07	5.10	5.11
ARRAY MASS (KG)	192.3	211.3	222.4	239.5	255.2	260.3
ARRAY WEIGHT (LB)	423.1	465.0	489.3	526.9	561.4	572.6
CENTER OF GRAVITY (IN)	689.4	678.0	671.2	656.5	641.3	637.5
TENSION PER BLANKET (LB)	1.50	10.50	18.50	32.00	45.00	50.00
MOMENT OF INERTIA I1	.3467+09	.3818+09	.4015+09	.4279+09	.4494+09	.4570+09
MOMENT OF INERTIA I2	.3839+07	.3721+07	.3673+07	.3625+07	.3597+07	.3587+07
SPECIFIC POWER (KW/KG)	.260	.237	.225	.209	.196	.192
SPECIFIC WEIGHT (KG/KW)	3.8	4.2	4.4	4.8	5.1	5.2
BLANKET - MAST CLEARANCE (IN)	13.3	12.9	12.8	12.8	12.7	12.7
* BOOM PROPERTIES *						
DIAMETER (IN)	8.84	14.60	16.88	19.43	21.22	21.80
EI (LB-IN-SQ)	.13179+07	.95177+07	.17005+08	.29879+08	.42480+08	.47370+08
ROOT SPRING (LB-IN/RAD)	.2836+05	.1249+06	.1930+06	.2946+06	.3836+06	.4162+06
BUCKLING CAPABILITY RATIO	34.79	13.56	10.29	7.89	6.69	6.35
STRENGTH CAPABILITY RATIO	.79	3.30	4.89	7.09	8.87	9.49
* CANNISTER PROPERTIES *						
HEIGHT (IN)	36.32	42.98	45.82	49.01	51.24	51.97
DIAMETER (IN)	10.43	17.22	19.91	22.93	25.03	25.73
* WEIGHTS (LB) *						
ARRAY	423.1	465.0	489.3	526.9	561.4	572.6
BOOM	10.7	28.7	38.6	51.6	61.8	65.4
CANNISTER	11.5	31.4	41.9	55.6	66.3	70.0
TENSION MECHANISM	1.5	3.8	6.4	9.6	13.5	13.8
MAST SLEEVE	4.0	5.9	6.7	7.6	8.2	8.4
SHAFT	15.7	15.2	15.0	20.5	27.9	30.8
HEADER	2.8	3.9	4.9	6.5	8.1	8.7
DRUM BEARING	1.5	1.8	2.0	2.4	2.8	2.9
CENTER SUPPORT	25.2	24.6	24.3	24.0	23.8	23.7
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	10.6	10.6	10.6	10.6	10.6	10.6
LEADING EDGE MEMBERS	4.9	4.8	4.8	4.7	4.7	4.7
DRUMS	28.0	27.5	27.4	27.2	27.0	27.0
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 50.0 KW   ARRAY WIDTH = 9.50 M

BLANKET AREA = .55556+06 IN-SQ   BLANKET WEIGHT = 305.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.013	.033	.043	.055	.064	.068
***** TORSIONAL FREQUENCY HZ *****	.013	.033	.043	.055	.064	.068
***** BENDING FREQUENCY HZ *****	.024	.063	.084	.110	.130	.137
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	169.7	167.1	166.0	164.8	164.0	163.8
ARRAY LENGTH (M)	41.57	42.23	42.50	42.80	43.02	43.09
ASPECT RATIO	4.38	4.45	4.47	4.51	4.53	4.54
ARRAY MASS (KG)	194.4	211.8	222.0	238.9	254.3	259.4
ARRAY WEIGHT (LB)	427.8	466.0	488.4	525.5	559.6	570.8
CENTER OF GRAVITY (IN)	639.3	632.0	626.7	611.8	597.0	591.8
TENSION PER BLANKET (LB)	1.50	10.50	18.50	32.00	45.00	50.00
MOMENT OF INERTIA I1	.3057+09	.3356+09	.3519+09	.3740+09	.3921+09	.3977+09
MOMENT OF INERTIA I2	.4378+07	.4242+07	.4192+07	.4145+07	.4118+07	.4109+07
SPECIFIC POWER (KW/KG)	.257	.236	.225	.209	.197	.193
SPECIFIC WEIGHT (KG/KW)	3.9	4.2	4.4	4.8	5.1	5.2
BLANKET - MAST CLEARANCE (IN)	13.1	13.0	12.9	12.9	12.9	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	8.43	13.93	16.10	18.53	20.23	20.95
EI (LB-IN-SQ)	.11629+07	.84030+07	.14994+08	.26307+08	.37363+08	.41649+08
ROOT SPRING (LB-IN/RAD)	.2582+05	.1138+06	.1757+06	.2678+06	.3484+06	.3780+06
BUCKLING CAPABILITY RATIO	31.69	12.36	9.37	7.18	6.08	5.87
STRENGTH CAPABILITY RATIO	.73	3.07	4.56	6.62	8.29	9.10
* CANNISTER PROPERTIES *						
HEIGHT (IN)	35.18	41.62	44.35	47.41	49.55	49.87
DIAMETER (IN)	9.95	16.44	19.00	21.87	23.87	24.72
* WEIGHTS (LB) *						
ARRAY	427.8	466.0	488.4	525.5	559.6	570.8
BOOM	9.7	26.1	35.1	46.8	56.1	58.4
CANNISTER	10.5	28.6	38.3	50.7	60.4	64.7
TENSION MECHANISM	1.4	3.7	6.1	9.2	12.9	13.1
MAST SLEEVE	3.7	5.4	6.1	6.9	7.4	7.7
SHAFT	17.9	17.3	17.1	24.6	33.7	37.1
HEADER	2.8	4.1	5.2	7.1	8.8	9.5
DRUM BEARING	1.5	1.8	2.0	2.4	2.8	2.9
CENTER SUPPORT	28.0	27.3	27.0	26.7	26.4	26.4
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	10.6	10.6	10.6	10.6	10.6	10.6
LEADING EDGE MEMBERS	5.2	5.1	5.1	5.0	5.0	5.0
DRUMS	29.7	29.3	29.1	28.9	28.7	28.7
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 50.0 KW   ARRAY WIDTH = 10.00 M

BLANKET AREA = .55556+06 IN-SQ   BLANKET WEIGHT = 305.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.013	.034	.044	.057	.066	.070
***** TORSIONAL FREQUENCY HZ *****	.013	.034	.044	.057	.066	.070
***** BENDING FREQUENCY HZ *****	.025	.065	.086	.113	.134	.141

* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	179.8	177.2	177.2	175.1	174.3	174.0
ARRAY LENGTH (M)	39.25	39.82	39.82	40.31	40.49	40.55
ASPECT RATIO	3.93	3.98	3.98	4.03	4.05	4.05
ARRAY MASS (KG)	196.8	212.8	222.3	239.3	254.8	260.0
ARRAY WEIGHT (LB)	433.0	468.2	489.0	526.4	560.7	572.0
CENTER OF GRAVITY (IN)	595.5	590.6	582.6	570.1	555.3	551.3
TENSION PER BLANKET (LB)	1.50	10.50	18.50	32.00	45.00	50.00
MOMENT OF INERTIA I1	.2724+09	.2975+09	.3076+09	.3295+09	.3449+09	.3504+09
MOMENT OF INERTIA I2	.4939+07	.4800+07	.4808+07	.4707+07	.4682+07	.4674+07
SPECIFIC POWER (KW/KG)	.254	.235	.225	.209	.196	.192
SPECIFIC WEIGHT (KG/KW)	3.9	4.3	4.4	4.8	5.1	5.2
BLANKET - MAST CLEARANCE (IN)	13.0	13.0	12.0	12.9	12.8	12.8

* BOOM PROPERTIES *						
DIAMETER (IN)	8.13	13.32	15.35	17.84	19.48	20.01
EI (LB-IN-SQ)	.10369+07	.74724+07	.13166+08	.23327+08	.33098+08	.36884+08
ROOT SPRING (LB-IN/RAD)	.2369+05	.1042+06	.1593+06	.2447+06	.3181+06	.3450+06
BUCKLING CAPABILITY RATIO	29.46	11.30	8.51	6.65	5.63	5.35
STRENGTH CAPABILITY RATIO	.70	2.86	4.24	6.33	7.93	8.50

* CANNISTER PROPERTIES *						
HEIGHT (IN)	33.87	40.45	42.89	45.64	47.69	48.36
DIAMETER (IN)	9.59	15.72	18.11	21.06	22.98	23.61

* WEIGHTS (LB) *						
ARRAY	433.0	468.2	489.0	526.4	560.7	572.0
BOOM	8.8	24.0	31.8	42.2	50.5	53.3
CANNISTER	9.8	26.3	34.9	47.1	56.1	59.2
TENSION MECHANISM	1.4	3.5	5.9	8.8	12.3	12.5
MAST SLEEVE	3.4	5.0	5.6	6.4	6.9	7.0
SHAFT	20.2	19.6	19.6	29.2	40.2	44.4
HEADER	2.8	4.3	5.6	7.6	9.6	10.4
DRUM BEARING	1.5	1.8	2.0	2.4	2.8	2.9
CENTER SUPPORT	30.9	30.1	30.1	29.5	29.3	29.2
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	10.6	10.6	10.6	10.6	10.6	10.6
LEADING EDGE MEMBERS	5.5	5.4	5.4	5.4	5.3	5.3
DRUMS	31.4	31.0	31.0	30.6	30.5	30.4
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 55.0 KW ARRAY WIDTH = 7.00 M

BLANKET AREA = .61111+06 IN-SQ BLANKET WEIGHT = 335.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.017	.026	.035	.042	.053
***** TORSIONAL FREQUENCY HZ *****	.010	.017	.026	.035	.042	.053
***** BENDING FREQUENCY HZ *****	.018	.033	.052	.069	.086	.111
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	119.1	117.0	115.0	113.5	112.2	109.1
ARRAY LENGTH (M)	65.19	66.31	67.46	68.38	69.18	71.16
ASPECT RATIO	9.31	9.47	9.64	9.77	9.88	10.17
ARRAY MASS (KG)	205.5	222.4	245.2	268.1	291.9	334.4
ARRAY WEIGHT (LB)	452.1	489.2	539.5	589.8	642.3	735.7
CENTER OF GRAVITY (IN)	1061.6	1047.5	1028.2	1006.7	987.0	964.7
TENSION PER BLANKET (LB)	1.50	5.00	12.50	22.50	35.00	60.00
MOMENT OF INERTIA I1	.8357+09	.9082+09	.1001+10	.1088+10	.1177+10	.1360+10
MOMENT OF INERTIA I2	.2280+07	.2203+07	.2129+07	.2074+07	.2029+07	.1924+07
SPECIFIC POWER (KW/KG)	.268	.247	.224	.205	.188	.164
SPECIFIC WEIGHT (KG/KW)	3.7	4.0	4.5	4.9	5.3	6.1
BLANKET - MAST CLEARANCE (IN)	12.8	12.7	12.5	12.2	12.1	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	11.80	16.19	20.53	24.11	27.08	31.65
EI (LB-IN-SQ)	.28602+07	.98653+07	.25527+08	.47206+08	.75168+08	.13633+09
ROOT SPRING (LB-IN/RAD)	.5070+05	.1283+06	.2618+06	.4152+06	.5885+06	.9198+06
BUCKLING CAPABILITY RATIO	62.02	35.04	22.55	17.27	14.01	11.16
STRENGTH CAPABILITY RATIO	1.14	2.77	5.22	7.89	10.48	14.93
* CANNISTER PROPERTIES *						
HEIGHT (IN)	44.50	49.34	54.62	58.41	62.02	67.31
DIAMETER (IN)	13.92	19.10	24.23	28.45	31.96	37.34
* WEIGHTS (LB) *						
ARRAY	452.1	489.2	539.5	589.8	642.3	735.7
BOOM	19.1	35.7	58.3	79.3	101.3	138.4
CANNISTER	20.3	38.1	61.3	84.5	106.6	145.4
TENSION MECHANISM	1.8	3.2	6.0	10.2	16.0	25.3
MAST SLEEVE	7.0	9.1	11.2	13.0	14.5	17.1
SHAFT	9.4	9.1	8.8	8.6	9.1	13.8
HEADER	2.7	2.9	3.4	4.1	4.8	6.2
DRUM BEARING	1.5	1.6	1.8	2.1	2.5	3.2
CENTER SUPPORT	17.2	16.8	16.4	16.1	15.8	15.2
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.0	11.0	11.0	11.0	11.0	11.0
LEADING EDGE MEMBERS	3.6	3.6	3.5	3.5	3.4	3.3
DRUMS	21.2	20.9	20.5	20.3	20.0	19.5
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 55.0 KW ARRAY WIDTH = 7.50 M

BLANKET AREA = .61111+06 IN-SQ BLANKET WEIGHT = 335.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.018	.028	.036	.045	.057
***** TORSIONAL FREQUENCY HZ *****	.010	.018	.028	.036	.045	.057
***** BENDING FREQUENCY HZ *****	.019	.035	.054	.072	.090	.117
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	129.2	127.3	125.4	124.0	122.7	121.0
ARRAY LENGTH (M)	60.07	60.97	61.88	62.61	63.25	64.15
ASPECT RATIO	8.01	8.13	8.25	8.35	8.43	8.55
ARRAY MASS (KG)	205.7	220.6	240.6	260.7	282.0	318.5
ARRAY WEIGHT (LB)	452.6	485.3	529.4	573.5	620.5	700.7
CENTER OF GRAVITY (IN)	970.9	959.8	944.0	925.9	907.6	878.4
TENSION PER BLANKET (LB)	1.50	5.00	12.50	22.50	35.00	60.00
MOMENT OF INERTIA I1	.7058+09	.7597+09	.8287+09	.8926+09	.9581+09	.1066+10
MOMENT OF INERTIA I2	.2701+07	.2621+07	.2545+07	.2488+07	.2443+07	.2384+07
SPECIFIC POWER (KW/KG)	.267	.249	.229	.211	.195	.173
SPECIFIC WEIGHT (KG/KW)	3.7	4.0	4.4	4.7	5.1	5.8
BLANKET - MAST CLEARANCE (IN)	12.9	12.7	12.6	12.4	12.2	12.0
* BOOM PROPERTIES *						
DIAMETER (IN)	11.09	15.20	19.26	22.59	25.36	29.22
EI (LB-IN-SQ)	.24283+07	.83387+07	.21479+08	.39578+08	.62824+08	.11078+09
ROOT SPRING (LB-IN/RAD)	.4484+05	.1131+06	.2300+06	.3638+06	.5144+06	.7872+06
BUCKLING CAPABILITY RATIO	54.78	30.89	19.83	15.17	12.28	9.52
STRENGTH CAPABILITY RATIO	1.04	2.52	4.78	7.26	9.68	13.56
* CANNISTER PROPERTIES *						
HEIGHT (IN)	42.67	47.17	52.11	55.62	58.97	63.67
DIAMETER (IN)	13.08	17.94	22.72	26.66	29.93	34.48
* WEIGHTS (LB) *						
ARRAY	452.6	485.3	529.4	573.5	620.5	700.7
BOOM	17.0	31.4	51.2	69.3	88.2	118.9
CANNISTER	17.9	33.7	54.0	74.3	93.7	124.4
TENSION MECHANISM	1.7	3.1	5.6	9.5	14.8	23.1
MAST SLEEVE	6.2	8.0	9.8	11.3	12.6	14.5
SHAFT	11.2	10.8	10.5	10.3	11.6	18.5
HEADER	2.7	3.0	3.6	4.3	5.3	7.1
DRUM BEARING	1.5	1.6	1.8	2.1	2.5	3.2
CENTER SUPPORT	19.4	19.0	18.5	18.2	17.9	17.6
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.0	11.0	11.0	11.0	11.0	11.0
LEADING EDGE MEMBERS	4.0	3.9	3.8	3.8	3.8	3.7
DRUMS	22.9	22.6	22.3	22.0	21.8	21.5
LATCHES	.3	.3	.3	.3	.3	.3

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE GE ROLLOUT   POWER/WING = 55.0 KW   ARRAY WIDTH = 8.00 M

BLANKET AREA = .61111+06 IN=SQ   BLANKET WEIGHT = 335.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.029	.038	.047	.059
***** TORSIONAL FREQUENCY HZ *****	.010	.019	.029	.038	.047	.059
***** BENDING FREQUENCY HZ *****	.020	.036	.057	.075	.094	.122
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	139.3	137.5	135.7	134.3	133.1	131.5
ARRAY LENGTH (M)	55.71	56.45	57.20	57.79	58.31	59.04
ASPECT RATIO	6.96	7.06	7.15	7.22	7.29	7.38
ARRAY MASS (KG)	206.6	219.8	237.7	255.5	275.1	308.8
ARRAY WEIGHT (LB)	454.5	483.5	522.8	562.0	605.1	679.4
CENTER OF GRAVITY (IN)	892.3	884.2	870.3	856.8	839.6	809.1
TENSION PER BLANKET (LB)	1.50	5.00	12.50	22.50	35.00	60.00
MOMENT OF INERTIA I1	.6048+09	.6464+09	.6983+09	.7482+09	.7985+09	.8785+09
MOMENT OF INERTIA I2	.3158+07	.3075+07	.2995+07	.2937+07	.2891+07	.2832+07
SPECIFIC POWER (KW/KG)	.266	.250	.231	.215	.200	.178
SPECIFIC WEIGHT (KG/KW)	3.8	4.0	4.3	4.6	5.0	5.6
BLANKET = MAST CLEARANCE (IN)	12.9	12.8	12.7	12.6	12.5	12.2
* BOOM PROPERTIES *						
DIAMETER (IN)	10.52	14.31	18.25	21.25	23.84	27.64
EI (LB=IN=SQ)	.20893+07	.71498+07	.18352+08	.33723+08	.53400+08	.93845+08
ROOT SPRING (LB=IN/RAD)	.4006+05	.1008+06	.2044+06	.3226+06	.4554+06	.6951+06
BUCKLING CAPABILITY RATIO	49.37	27.40	17.81	13.41	10.85	8.51
STRENGTH CAPABILITY RATIO	.96	2.29	4.47	6.66	8.91	12.85
* CANNISTER PROPERTIES *						
HEIGHT (IN)	40.78	45.41	49.69	53.34	56.49	60.53
DIAMETER (IN)	12.42	16.89	21.54	25.07	28.13	32.62
* WEIGHTS (LB) *						
ARRAY	454.5	483.5	522.8	562.0	605.1	679.4
BOOM	15.0	28.1	45.0	61.7	78.3	103.6
CANNISTER	16.2	29.9	48.6	65.9	82.9	111.5
TENSION MECHANISM	1.6	2.9	5.2	8.9	13.8	21.5
MAST SLEEVE	5.6	7.1	8.8	10.0	11.1	12.8
SHAFT	13.0	12.7	12.3	12.1	14.5	23.4
HEADER	2.7	3.0	3.7	4.7	5.8	7.9
DRUM BEARING	1.5	1.6	1.8	2.1	2.5	3.2
CENTER SUPPORT	21.8	21.3	20.9	20.6	20.3	19.9
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.0	11.0	11.0	11.0	11.0	11.0
LEADING EDGE MEMBERS	4.3	4.2	4.2	4.1	4.1	4.0
DRUMS	24.6	24.3	24.0	23.8	23.6	23.3
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 55.0 KW   ARRAY WIDTH = 8.50 M

BLANKET AREA = .61111+06 IN-SQ   BLANKET WEIGHT = 335.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.019	.030	.040	.049	.062
***** TORSIONAL FREQUENCY HZ *****	.011	.019	.030	.040	.049	.062
***** BENDING FREQUENCY HZ *****	.021	.037	.059	.078	.097	.127
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	149.4	147.6	145.9	144.6	143.4	141.9
ARRAY LENGTH (M)	51.96	52.57	53.19	53.68	54.11	54.71
ASPECT RATIO	6.11	6.18	6.26	6.32	6.37	6.44
ARRAY MASS (KG)	208.0	219.8	235.8	251.9	270.3	302.2
ARRAY WEIGHT (LB)	457.5	483.5	518.8	554.1	594.7	664.8
CENTER OF GRAVITY (IN)	824.0	817.2	807.0	796.2	777.9	750.7
TENSION PER BLANKET (LB)	1.50	5.00	12.50	22.50	35.00	60.00
MOMENT OF INERTIA I1	.5247+09	.5569+09	.5983+09	.6377+09	.6761+09	.7410+09
MOMENT OF INERTIA I2	.3652+07	.3566+07	.3484+07	.3425+07	.3379+07	.3321+07
SPECIFIC POWER (KW/KG)	.264	.250	.233	.218	.203	.182
SPECIFIC WEIGHT (KG/KW)	3.8	4.0	4.3	4.6	4.9	5.5
BLANKET - MAST CLEARANCE (IN)	13.0	12.9	12.8	12.7	12.6	12.4
* BOOM PROPERTIES *						
DIAMETER (IN)	9.94	13.61	17.22	20.04	22.63	26.04
EI (LB-IN-SQ)	.18171+07	.62004+07	.15869+08	.29093+08	.45977+08	.80571+08
ROOT SPRING (LB-IN/RAD)	.3608+05	.9058+05	.1833+06	.2888+06	.4070+06	.6200+06
BUCKLING CAPABILITY RATIO	44.06	24.78	15.86	11.93	9.78	7.55
STRENGTH CAPABILITY RATIO	.87	2.14	4.08	6.10	8.38	11.83
* CANNISTER PROPERTIES *						
HEIGHT (IN)	39.57	43.58	48.00	51.45	54.06	58.22
DIAMETER (IN)	11.73	16.06	20.32	23.64	26.70	30.72
* WEIGHTS (LB) *						
ARRAY	457.5	483.5	518.8	554.1	594.7	664.8
BOOM	13.6	25.1	40.7	55.6	69.4	92.9
CANNISTER	14.5	27.1	43.4	58.8	74.9	99.2
TENSION MECHANISM	1.6	2.8	4.9	8.4	13.0	20.2
MAST SLEEVE	5.0	6.4	7.8	8.9	10.0	11.4
SHAFT	15.0	14.7	14.3	14.0	18.0	29.2
HEADER	2.7	3.1	3.9	5.0	6.3	8.8
DRUM BEARING	1.5	1.6	1.8	2.1	2.5	3.2
CENTER SUPPORT	24.3	23.9	23.4	23.1	22.8	22.4
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.0	11.0	11.0	11.0	11.0	11.0
LEADING EDGE MEMBERS	4.6	4.5	4.5	4.4	4.4	4.3
DRUMS	26.3	26.1	25.8	25.5	25.3	25.1
LATCHES	.3	.3	.3	.3	.3	.3

ORIGINAL PAGE IS
OF POOR QUALITY

ARRAY TYPE GE ROLLOUT POWER/WING = 55.0 KW ARRAY WIDTH = 9.00 M

BLANKET AREA = .61111+06 IN*SQ BLANKET WEIGHT = 335.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.020	.031	.041	.050	.064
***** TORSIONAL FREQUENCY HZ *****	.011	.020	.031	.041	.050	.064
***** BENDING FREQUENCY HZ *****	.021	.039	.061	.081	.101	.131
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	159.4	157.8	156.1	154.8	153.7	152.2
ARRAY LENGTH (M)	48.67	49.20	49.72	50.12	50.48	50.98
ASPECT RATIO	5.41	5.47	5.52	5.57	5.61	5.66
ARRAY MASS (KG)	209.7	220.4	235.0	249.5	267.3	298.1
ARRAY WEIGHT (LB)	461.4	484.9	516.9	549.0	588.2	655.8
CENTER OF GRAVITY (IN)	763.3	758.1	750.0	741.2	724.8	696.5
TENSION PER BLANKET (LB)	1.50	5.00	12.50	22.50	35.00	60.00
MOMENT OF INERTIA I1	.4595+09	.4854+09	.5185+09	.5502+09	.5823+09	.6339+09
MOMENT OF INERTIA I2	.4185+07	.4095+07	.4012+07	.3951+07	.3905+07	.3849+07
SPECIFIC POWER (KW/KG)	.262	.250	.234	.220	.206	.185
SPECIFIC WEIGHT (KG/KW)	3.8	4.0	4.3	4.5	4.9	5.4
BLANKET - MAST CLEARANCE (IN)	13.0	12.9	12.9	12.8	12.7	12.5
* BOOM PROPERTIES *						
DIAMETER (IN)	9.48	12.98	16.40	19.08	21.38	24.77
EI (LB-IN-SQ)	.15946+07	.54299+07	.13863+08	.25366+08	.40020+08	.69966+08
ROOT SPRING (LB-IN/RAD)	.3271+05	.8200+05	.1656+06	.2606+06	.3668+06	.5577+06
BUCKLING CAPABILITY RATIO	40.06	22.51	14.39	10.81	8.73	6.83
STRENGTH CAPABILITY RATIO	.81	1.99	3.81	5.70	7.67	11.12
* CANNISTER PROPERTIES *						
HEIGHT (IN)	38.18	42.01	46.22	49.51	52.35	55.93
DIAMETER (IN)	11.19	15.31	19.35	22.51	25.23	29.23
* WEIGHTS (LB) *						
ARRAY	461.4	484.9	516.9	549.0	588.2	655.8
BOOM	12.3	22.7	36.6	49.9	63.1	83.0
CANNISTER	13.2	24.7	39.5	53.4	67.1	89.9
TENSION MECHANISM	1.5	2.7	4.7	7.9	12.3	19.0
MAST SLEEVE	4.6	5.9	7.1	8.1	9.0	10.2
SHAFT	17.2	16.8	16.4	16.2	21.9	35.8
HEADER	2.8	3.2	4.1	5.3	6.8	9.7
DRUM BEARING	1.5	1.6	1.8	2.1	2.5	3.2
CENTER SUPPORT	27.1	26.6	26.2	25.8	25.5	25.1
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.0	11.0	11.0	11.0	11.0	11.0
LEADING EDGE MEMBERS	4.9	4.8	4.8	4.7	4.7	4.7
DRUMS	28.1	27.8	27.5	27.3	27.1	26.8
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 55.0 KW ARRAY WIDTH = 9.50 M

BLANKET AREA = .61111+06 IN-SQ BLANKET WEIGHT = 335.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.012	.021	.032	.043	.052	.067
***** TORSIONAL FREQUENCY HZ *****	.012	.021	.032	.043	.052	.067
***** BENDING FREQUENCY HZ *****	.022	.040	.063	.084	.104	.136
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	169.4	168.3	166.2	165.0	163.9	162.5
ARRAY LENGTH (M)	45.81	46.11	46.69	47.04	47.34	47.76
ASPECT RATIO	4.82	4.85	4.91	4.95	4.98	5.03
ARRAY MASS (KG)	211.8	221.7	234.9	248.3	265.9	296.1
ARRAY WEIGHT (LB)	466.0	487.7	516.8	546.2	584.9	651.4
CENTER OF GRAVITY (IN)	709.7	703.3	699.5	692.6	675.8	648.2
TENSION PER BLANKET (LB)	1.50	5.00	12.50	22.50	35.00	60.00
MOMENT OF INERTIA I1	.4065+09	.4249+09	.4546+09	.4808+09	.5075+09	.5506+09
MOMENT OF INERTIA I2	.4751+07	.4689+07	.4575+07	.4513+07	.4468+07	.4415+07
SPECIFIC POWER (KW/KG)	.260	.248	.234	.222	.207	.186
SPECIFIC WEIGHT (KG/KW)	3.9	4.0	4.3	4.5	4.8	5.4
BLANKET - MAST CLEARANCE (IN)	13.0	12.5	13.0	12.9	12.9	12.7
* BOOM PROPERTIES *						
DIAMETER (IN)	9.06	12.38	15.66	18.20	20.40	23.62
EI (LB-IN-SQ)	.14123+07	.47707+07	.12227+08	.22338+08	.35196+08	.61419+08
ROOT SPRING (LB-IN/RAD)	.2987+05	.7442+05	.1507+06	.2369+06	.3331+06	.5058+06
BUCKLING CAPABILITY RATIO	36.58	20.48	13.11	9.85	7.95	6.22
STRENGTH CAPABILITY RATIO	.75	1.85	3.55	5.33	7.18	10.43
* CANNISTER PROPERTIES *						
HEIGHT (IN)	37.01	40.57	44.70	47.85	50.57	53.97
DIAMETER (IN)	10.69	14.60	18.48	21.48	24.07	27.87
* WEIGHTS (LB) *						
ARRAY	466.0	487.7	516.8	546.2	584.9	651.4
BOOM	11.3	20.5	33.3	45.3	57.2	75.1
CANNISTER	12.1	22.5	36.0	48.7	61.2	81.9
TENSION MECHANISM	1.5	2.5	4.5	7.6	11.6	18.0
MAST SLEEVE	4.2	5.3	6.5	7.4	8.1	9.3
SHAFT	19.5	19.2	18.7	18.4	26.4	43.4
HEADER	2.8	3.3	4.3	5.7	7.4	10.8
DRUM BEARING	1.5	1.6	1.8	2.1	2.5	3.2
CENTER SUPPORT	30.0	29.7	29.1	28.7	28.4	28.0
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.0	11.0	11.0	11.0	11.0	11.0
LEADING EDGE MEMBERS	5.2	5.1	5.1	5.0	5.0	5.0
DRUMS	29.7	29.6	29.2	29.0	28.8	28.6
LATCHES	.3	.3	.3	.3	.3	.3

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE GE ROLLOUT POWER/WING = 55.0 KW ARRAY WIDTH = 10.00 M

BLANKET AREA = .61111+06 IN-SQ BLANKET WEIGHT = 335.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.012	.021	.033	.044	.054	.069
***** TORSIONAL FREQUENCY HZ *****	.012	.021	.033	.044	.054	.069
***** BENDING FREQUENCY HZ *****	.023	.041	.065	.086	.107	.140
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	179.5	177.2	177.2	175.2	174.2	172.8
ARRAY LENGTH (M)	43.25	43.81	43.81	44.30	44.56	44.92
ASPECT RATIO	4.32	4.38	4.38	4.43	4.46	4.49
ARRAY MASS (KG)	214.3	223.1	235.5	247.8	265.6	295.9
ARRAY WEIGHT (LB)	471.4	490.8	518.2	545.3	584.4	650.9
CENTER OF GRAVITY (IN)	661.1	661.9	650.5	648.6	629.9	603.8
TENSION PER BLANKET (LB)	1.50	5.00	12.50	22.50	35.00	60.00
MOMENT OF INERTIA I1	.3620+09	.3827+09	.3983+09	.4240+09	.4458+09	.4835+09
MOMENT OF INERTIA I2	.5360+07	.5222+07	.5229+07	.5118+07	.5076+07	.5027+07
SPECIFIC POWER (KW/KG)	.257	.247	.234	.222	.207	.186
SPECIFIC WEIGHT (KG/KW)	3.9	4.1	4.3	4.5	4.8	5.4
BLANKET - MAST CLEARANCE (IN)	13.0	13.7	12.2	13.0	12.8	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	8.74	11.88	14.94	17.40	19.64	22.56
EI (LB-IN-SQ)	.12589+07	.43055+07	.10764+08	.19812+08	.31177+08	.54313+08
ROOT SPRING (LB-IN/RAD)	.2740+05	.6890+05	.1370+06	.2165+06	.3042+06	.4612+06
BUCKLING CAPABILITY RATIO	34.01	18.87	11.93	8.99	7.36	5.67
STRENGTH CAPABILITY RATIO	.72	1.73	3.31	4.98	6.88	9.77
* CANNISTER PROPERTIES *						
HEIGHT (IN)	35.61	39.63	43.23	46.41	48.64	52.26
DIAMETER (IN)	10.31	14.02	17.63	20.53	23.17	26.62
* WEIGHTS (LB) *						
ARRAY	471.4	490.8	518.2	545.3	584.4	650.9
BOOM	10.2	19.1	30.2	41.4	51.5	68.5
CANNISTER	11.2	20.8	32.9	44.6	56.8	74.9
TENSION MECHANISM	1.5	2.5	4.3	7.2	11.1	17.2
MAST SLEEVE	3.9	5.0	5.9	6.7	7.5	8.5
SHAFT	21.9	21.3	21.3	20.9	31.4	52.0
HEADER	2.8	3.4	4.6	6.1	8.0	11.8
DRUM BEARING	1.5	1.6	1.8	2.1	2.5	3.2
CENTER SUPPORT	33.2	32.4	32.4	31.8	31.5	31.1
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.0	11.0	11.0	11.0	11.0	11.0
LEADING EDGE MEMBERS	5.5	5.4	5.4	5.4	5.3	5.3
DRUMS	31.4	31.1	31.1	30.7	30.6	30.3
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 60.0 KW ARRAY WIDTH = 7.00 M

BLANKET AREA = .66667+06 IN-SQ BLANKET WEIGHT = 366.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.018	.026	.035	.042	.052
***** TORSIONAL FREQUENCY HZ *****	.011	.018	.026	.035	.042	.052
***** BENDING FREQUENCY HZ *****	.022	.036	.052	.070	.086	.109
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	117.8	115.8	113.9	112.1	109.4	107.2
ARRAY LENGTH (M)	71.85	73.12	74.33	75.51	77.37	78.95
ASPECT RATIO	10.26	10.45	10.62	10.79	11.05	11.28
ARRAY MASS (KG)	230.0	250.9	276.2	306.0	337.9	388.8
ARRAY WEIGHT (LB)	506.1	551.9	607.6	673.2	743.4	855.3
CENTER OF GRAVITY (IN)	1167.3	1144.1	1121.3	1099.1	1086.4	1048.2
TENSION PER BLANKET (LB)	2.50	7.00	15.00	27.50	42.50	70.00
MOMENT OF INERTIA I1	.1128+10	.1233+10	.1354+10	.1496+10	.1676+10	.1904+10
MOMENT OF INERTIA I2	.2422+07	.2338+07	.2263+07	.2195+07	.2093+07	.2020+07
SPECIFIC POWER (KW/KG)	.261	.239	.217	.196	.178	.154
SPECIFIC WEIGHT (KG/KW)	3.8	4.2	4.6	5.1	5.6	6.5
BLANKET - MAST CLEARANCE (IN)	12.8	12.6	12.3	12.1	12.9	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	14.37	18.88	23.18	27.19	30.90	35.59
EI (LB-IN-SQ)	.57908+07	.16791+08	.37184+08	.70353+08	.11415+09	.19577+09
ROOT SPRING (LB-IN/RAD)	.8606+05	.1912+06	.3471+06	.5600+06	.8051+06	.1207+07
BUCKLING CAPABILITY RATIO	55.20	34.03	23.95	17.97	15.01	12.10
STRENGTH CAPABILITY RATIO	1.69	3.56	6.12	9.09	12.21	16.82
* CANNISTER PROPERTIES *						
HEIGHT (IN)	48.93	53.86	58.50	63.34	67.57	72.70
DIAMETER (IN)	16.95	22.27	27.36	32.08	36.46	42.00
* WEIGHTS (LB) *						
ARRAY	506.1	551.9	607.6	673.2	743.4	855.3
BOOM	28.8	49.2	73.4	102.6	132.2	174.3
CANNISTER	30.0	51.7	77.9	107.2	138.3	183.5
TENSION MECHANISM	2.3	4.4	7.6	12.4	18.5	33.9
MAST SLEEVE	8.9	11.2	13.5	15.8	18.0	20.8
SHAFT	10.0	9.7	9.4	9.1	10.1	15.2
HEADER	2.7	3.0	3.6	4.3	5.2	6.7
DRUM BEARING	1.5	1.7	1.9	2.3	2.7	3.5
CENTER SUPPORT	17.9	17.5	17.1	16.7	16.2	15.7
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.4	11.4	11.4	11.4	11.4	11.4
LEADING EDGE MEMBERS	3.6	3.5	3.5	3.4	3.3	3.3
DRUMS	21.1	20.8	20.4	20.1	19.7	19.3
LATCHES	.3	.3	.3	.3	.3	.3

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE GE ROLLOUT　　POWER/WING = 60.0 KW　　ARRAY WIDTH = 7.50 M

BLANKET AREA = .66667+06 IN-SQ　　BLANKET WEIGHT = 366.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.012	.019	.028	.036	.044	.055
***** TORSIONAL FREQUENCY HZ *****	.012	.019	.028	.036	.044	.055
***** BENDING FREQUENCY HZ *****	.023	.037	.054	.073	.090	.114
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	128.1	126.1	124.3	122.7	121.3	118.2
ARRAY LENGTH (M)	66.12	67.13	68.09	69.03	69.81	71.61
ASPECT RATIO	8.82	8.95	9.08	9.20	9.31	9.55
ARRAY MASS (KG)	229.3	247.5	269.7	295.7	322.5	368.8
ARRAY WEIGHT (LB)	504.4	544.6	593.3	650.6	709.6	811.4
CENTER OF GRAVITY (IN)	1063.7	1048.9	1029.9	1010.9	990.2	962.3
TENSION PER BLANKET (LB)	2.50	7.00	15.00	27.50	42.50	70.00
MOMENT OF INERTIA I1	.9472+09	.1025+10	.1114+10	.1217+10	.1318+10	.1508+10
MOMENT OF INERTIA I2	.2875+07	.2789+07	.2711+07	.2641+07	.2587+07	.2470+07
SPECIFIC POWER (KW/KG)	.262	.242	.222	.203	.186	.163
SPECIFIC WEIGHT (KG/KW)	3.8	4.1	4.5	4.9	5.4	6.1
BLANKET - MAST CLEARANCE (IN)	12.8	12.7	12.4	12.2	12.1	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	13.50	17.72	21.74	25.47	28.56	33.00
EI (LB-IN-SQ)	.49036+07	.14154+08	.31208+08	.58797+08	.92944+08	.16108+09
ROOT SPRING (LB-IN/RAD)	.7597+05	.1682+06	.3044+06	.4895+06	.6901+06	.1042+07
BUCKLING CAPABILITY RATIO	48.73	29.98	21.06	15.77	12.83	10.40
STRENGTH CAPABILITY RATIO	1.53	3.26	5.62	8.40	11.09	15.38
* CANNISTER PROPERTIES *						
HEIGHT (IN)	46.81	51.39	55.70	60.19	63.92	68.98
DIAMETER (IN)	15.93	20.91	25.65	30.06	33.70	38.93
* WEIGHTS (LB) *						
ARRAY	504.4	544.6	593.3	650.6	709.6	811.4
BOOM	25.4	43.2	64.2	89.4	113.6	151.3
CANNISTER	26.5	45.6	68.7	94.3	118.5	158.1
TENSION MECHANISM	2.2	4.1	7.1	11.5	16.9	31.0
MAST SLEEVE	7.8	9.9	11.8	13.7	15.3	17.8
SHAFT	11.9	11.5	11.2	10.9	13.4	20.0
HEADER	2.8	3.1	3.8	4.7	5.8	7.6
DRUM BEARING	1.5	1.7	1.9	2.3	2.7	3.5
CENTER SUPPORT	20.3	19.9	19.4	19.0	18.7	18.0
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.4	11.4	11.4	11.4	11.4	11.4
LEADING EDGE MEMBERS	3.9	3.9	3.8	3.8	3.7	3.6
DRUMS	22.8	22.5	22.2	21.9	21.7	21.2
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 60.0 KW ARRAY WIDTH = 8.00 M

BLANKET AREA = .66667+06 IN-SQ BLANKET WEIGHT = 366.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.012	.020	.029	.038	.047	.058
***** TORSIONAL FREQUENCY HZ *****	.012	.020	.029	.038	.047	.058
***** BENDING FREQUENCY HZ *****	.023	.039	.057	.076	.094	.120
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	138.2	136.4	134.6	133.0	131.7	130.0
ARRAY LENGTH (M)	61.26	62.09	62.88	63.64	64.27	65.11
ASPECT RATIO	7.66	7.76	7.86	7.95	8.03	8.14
ARRAY MASS (KG)	229.3	245.6	265.2	288.3	312.9	353.7
ARRAY WEIGHT (LB)	504.6	540.2	583.4	634.2	688.4	778.1
CENTER OF GRAVITY (IN)	978.0	967.1	951.6	935.8	915.8	879.2
TENSION PER BLANKET (LB)	2.50	7.00	15.00	27.50	42.50	70.00
MOMENT OF INERTIA I1	.8080+09	.8678+09	.9354+09	.1014+10	.1091+10	.1204+10
MOMENT OF INERTIA I2	.3366+07	.3277+07	.3197+07	.3124+07	.3069+07	.3007+07
SPECIFIC POWER (KW/KG)	.262	.244	.226	.208	.192	.170
SPECIFIC WEIGHT (KG/KW)	3.8	4.1	4.4	4.8	5.2	5.9
BLANKET - MAST CLEARANCE (IN)	12.9	12.8	12.6	12.5	12.3	12.0
* BOOM PROPERTIES *						
DIAMETER (IN)	12.81	16.69	20.46	23.95	26.84	30.82
EI (LB-IN-SQ)	.42104+07	.12110+08	.26612+08	.49975+08	.78783+08	.13317+09
ROOT SPRING (LB-IN/RAD)	.6776+05	.1497+06	.2701+06	.4333+06	.6096+06	.9037+06
BUCKLING CAPABILITY RATIO	43.90	26.59	18.65	13.94	11.33	9.07
STRENGTH CAPABILITY RATIO	1.43	2.97	5.16	7.74	10.25	14.30
* CANNISTER PROPERTIES *						
HEIGHT (IN)	44.68	49.38	53.40	57.62	61.10	65.30
DIAMETER (IN)	15.12	19.69	24.14	28.26	31.67	36.36
* WEIGHTS (LB) *						
ARRAY	504.6	540.2	583.4	634.2	688.4	778.1
BOOM	22.4	38.6	57.1	79.2	100.4	130.4
CANNISTER	23.9	40.6	61.0	83.5	104.9	138.2
TENSION MECHANISM	2.1	3.9	6.6	10.7	15.7	28.5
MAST SLEEVE	7.0	8.8	10.5	12.1	13.5	15.4
SHAFT	13.9	13.5	13.2	12.9	17.0	26.3
HEADER	2.8	3.2	4.0	5.1	6.4	8.7
DRUM BEARING	1.5	1.7	1.9	2.3	2.7	3.5
CENTER SUPPORT	22.9	22.4	22.0	21.6	21.2	20.8
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.4	11.4	11.4	11.4	11.4	11.4
LEADING EDGE MEMBERS	4.2	4.2	4.1	4.1	4.0	4.0
DRUMS	24.5	24.2	23.9	23.7	23.5	23.2
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 60.0 KW ARRAY WIDTH = 8.50 M

BLANKET AREA = .66667+06 IN=SQ BLANKET WEIGHT = 366.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.013	.021	.030	.040	.049	.061
***** TORSIONAL FREQUENCY HZ *****	.013	.021	.030	.040	.049	.061
***** BENDING FREQUENCY HZ *****	.024	.040	.059	.079	.098	.125
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	148.3	146.6	144.9	143.4	142.1	140.5
ARRAY LENGTH (M)	57.09	57.77	58.42	59.05	59.57	60.26
ASPECT RATIO	6.72	6.80	6.87	6.95	7.01	7.09
ARRAY MASS (KG)	230.1	244.6	262.2	283.0	306.2	344.4
ARRAY WEIGHT (LB)	506.1	538.2	576.9	622.5	673.6	757.7
CENTER OF GRAVITY (IN)	903.8	894.4	883.0	868.3	848.2	815.7
TENSION PER BLANKET (LB)	2.50	7.00	15.00	27.50	42.50	70.00
MOMENT OF INERTIA I1	.6986+09	.7446+09	.7984+09	.8587+09	.9184+09	.1010+10
MOMENT OF INERTIA I2	.3898+07	.3805+07	.3723+07	.3649+07	.3594+07	.3532+07
SPECIFIC POWER (KW/KG)	.261	.245	.229	.212	.196	.174
SPECIFIC WEIGHT (KG/KW)	3.8	4.1	4.4	4.7	5.1	5.7
BLANKET - MAST CLEARANCE (IN)	13.0	12.8	12.7	12.6	12.5	12.3
* BOOM PROPERTIES *						
DIAMETER (IN)	12.10	15.87	19.30	22.75	25.47	29.02
EI (LB=IN=SQ)	.36556+07	.10483+08	.22973+08	.43025+08	.67675+08	.11405+09
ROOT SPRING (LB=IN/RAD)	.6095+05	.1343+06	.2419+06	.3873+06	.5439+06	.8045+06
BUCKLING CAPABILITY RATIO	39.18	24.04	16.61	12.58	10.21	8.04
STRENGTH CAPABILITY RATIO	1.30	2.77	4.72	7.28	9.67	13.23
* CANNISTER PROPERTIES *						
HEIGHT (IN)	43.26	47.32	51.49	55.10	58.39	62.68
DIAMETER (IN)	14.28	18.72	22.78	26.84	30.06	34.25
* WEIGHTS (LB) *						
ARRAY	506.1	538.2	576.9	622.5	673.6	757.7
BOOM	20.3	34.4	51.4	70.1	88.7	116.5
CANNISTER	21.4	36.8	54.4	75.5	94.6	122.9
TENSION MECHANISM	2.0	3.7	6.3	10.1	14.7	26.6
MAST SLEEVE	6.3	7.9	9.3	10.8	12.0	13.6
SHAFT	10.1	15.7	15.3	15.0	21.1	32.9
HEADER	2.8	3.3	4.2	5.5	7.0	9.7
DRUM BEARING	1.5	1.7	1.9	2.3	2.7	3.5
CENTER SUPPORT	25.7	25.2	24.7	24.3	23.9	23.5
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.4	11.4	11.4	11.4	11.4	11.4
LEADING EDGE MEMBERS	4.5	4.5	4.4	4.4	4.3	4.3
DRUMS	26.3	26.0	25.7	25.4	25.2	24.9
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 60.0 KW   ARRAY WIDTH = 9.00 M

BLANKET AREA = .66667+06 IN-SQ   BLANKET WEIGHT = 366.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.013	.022	.031	.041	.050	.063
***** TORSIONAL FREQUENCY HZ *****	.013	.022	.031	.041	.050	.063
***** BENDING FREQUENCY HZ *****	.025	.042	.061	.082	.101	.129
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	158.4	156.7	155.2	153.7	152.5	150.9
ARRAY LENGTH (M)	53.45	54.02	54.57	55.09	55.53	56.10
ASPECT RATIO	5.94	6.00	6.06	6.12	6.17	6.23
ARRAY MASS (KG)	231.4	244.5	260.4	279.3	301.7	338.3
ARRAY WEIGHT (LB)	509.0	537.9	573.0	614.4	663.7	744.4
CENTER OF GRAVITY (IN)	837.8	830.2	821.0	810.4	788.4	756.7
TENSION PER BLANKET (LB)	2.50	7.00	15.00	27.50	42.50	70.00
MOMENT OF INERTIA I1	.6101+09	.6467+09	.6896+09	.7392+09	.7857+09	.8593+09
MOMENT OF INERTIA I2	.4470+07	.4375+07	.4291+07	.4215+07	.4161+07	.4102+07
SPECIFIC POWER (KW/KG)	.259	.245	.230	.215	.199	.177
SPECIFIC WEIGHT (KG/KW)	3.9	4.1	4.3	4.7	5.0	5.6
BLANKET - MAST CLEARANCE (IN)	13.0	12.9	12.8	12.7	12.6	12.4
* BOOM PROPERTIES *						
DIAMETER (IN)	11.54	15.12	18.39	21.50	24.24	27.60
EI (LB-IN-SQ)	.32044+07	.91668+07	.20041+08	.37449+08	.58794+08	.98838+08
ROOT SPRING (LB-IN/RAD)	.5521+05	.1214+06	.2184+06	.3490+06	.4895+06	.7226+06
BUCKLING CAPABILITY RATIO	35.63	21.84	15.07	11.24	9.24	7.28
STRENGTH CAPABILITY RATIO	1.21	2.59	4.42	6.67	9.10	12.48
* CANNISTER PROPERTIES *						
HEIGHT (IN)	41.70	45.55	49.52	53.31	56.06	60.13
DIAMETER (IN)	13.62	17.84	21.70	25.37	28.60	32.57
* WEIGHTS (LB) *						
ARRAY	509.0	537.9	573.0	614.4	663.7	744.4
BOOM	18.4	30.9	46.2	63.8	79.4	103.9
CANNISTER	19.5	33.4	49.5	67.6	85.9	111.3
TENSION MECHANISM	1.9	3.5	5.9	9.5	13.9	25.0
MAST SLEEVE	5.8	7.2	8.5	9.7	10.8	12.2
SHAFT	18.4	18.0	17.6	17.4	25.8	40.6
HEADER	2.9	3.4	4.4	5.9	7.7	10.8
DRUM BEARING	1.5	1.7	1.9	2.3	2.7	3.5
CENTER SUPPORT	28.6	28.1	27.6	27.2	26.9	26.4
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.4	11.4	11.4	11.4	11.4	11.4
LEADING EDGE MEMBERS	4.8	4.8	4.7	4.7	4.7	4.6
DRUMS	28.0	27.7	27.4	27.2	27.0	26.7
LATCHES	.3	.3	.3	.3	.3	.3

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE GE ROLLOUT   POWER/WING = 60.0 KW   ARRAY WIDTH = 9.50 M

BLANKET AREA = .66667+06 IN-SQ   BLANKET WEIGHT = 366.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.014	.022	.032	.043	.052	.065
***** TORSIONAL FREQUENCY HZ *****	.014	.022	.032	.043	.052	.065
***** BENDING FREQUENCY HZ *****	.026	.043	.063	.084	.105	.134
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	168.3	166.9	165.4	164.0	162.6	161.3
ARRAY LENGTH (M)	50.31	50.74	51.20	51.64	52.00	52.48
ASPECT RATIO	5.30	5.34	5.39	5.44	5.47	5.52
ARRAY MASS (KG)	233.1	245.1	259.6	277.4	299.1	334.9
ARRAY WEIGHT (LB)	512.8	539.2	571.2	610.2	658.0	736.7
CENTER OF GRAVITY (IN)	780.0	773.1	765.8	756.0	736.4	703.8
TENSION PER BLANKET (LB)	2.50	7.00	15.00	27.50	42.50	70.00
MOMENT OF INERTIA I1	.5391+09	.5676+09	.6025+09	.6431+09	.6829+09	.7423+09
MOMENT OF INERTIA I2	.5072+07	.4987+07	.4901+07	.4825+07	.4772+07	.4716+07
SPECIFIC POWER (KW/KG)	.257	.245	.231	.216	.201	.179
SPECIFIC WEIGHT (KG/KW)	3.9	4.1	4.3	4.6	5.0	5.6
BLANKET - MAST CLEARANCE (IN)	13.2	12.9	12.9	12.8	12.7	12.5
* BOOM PROPERTIES *						
DIAMETER (IN)	11.03	14.44	17.55	20.51	22.95	26.31
EI (LB-IN-SQ)	.28387+07	.80858+07	.17642+08	.32904+08	.51575+08	.86522+08
ROOT SPRING (LB-IN/RAD)	.5042+05	.1105+06	.1984+06	.3167+06	.4437+06	.6540+06
BUCKLING CAPABILITY RATIO	32.55	19.92	13.73	10.23	8.28	6.61
STRENGTH CAPABILITY RATIO	1.12	2.42	4.13	6.25	8.34	11.75
* CANNISTER PROPERTIES *						
HEIGHT (IN)	40.39	44.03	47.82	51.44	54.41	57.92
DIAMETER (IN)	13.02	17.04	20.71	24.20	27.08	31.05
* WEIGHTS (LB) *						
ARRAY	512.8	539.2	571.2	610.2	658.0	736.7
BOOM	16.8	28.1	41.9	57.7	72.7	93.7
CANNISTER	17.9	30.6	45.1	61.7	77.2	101.4
TENSION MECHANISM	1.9	3.4	5.7	9.0	13.2	23.7
MAST SLEEVE	5.3	6.5	7.7	8.8	9.8	11.1
SHAFT	20.8	20.5	20.1	20.9	31.2	49.4
HEADER	2.9	3.6	4.7	6.4	8.4	12.0
DRUM BEARING	1.5	1.7	1.9	2.3	2.7	3.5
CENTER SUPPORT	31.8	31.3	30.8	30.4	30.0	29.5
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.4	11.4	11.4	11.4	11.4	11.4
LEADING EDGE MEMBERS	5.1	5.1	5.1	5.0	5.0	4.9
DRUMS	29.7	29.4	29.2	28.9	28.7	28.5
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 60.0 KW ARRAY WIDTH = 10.00 M

BLANKET AREA = .66667+06 IN-SQ BLANKET WEIGHT = 366.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.014	.023	.033	.044	.054	.067
***** TORSIONAL FREQUENCY HZ *****	.014	.023	.033	.044	.054	.067
***** BENDING FREQUENCY HZ *****	.027	.044	.065	.087	.108	.138
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	178.5	177.2	175.5	174.1	173.0	171.6
ARRAY LENGTH (M)	47.43	47.79	48.24	48.62	48.94	49.35
ASPECT RATIO	4.74	4.78	4.82	4.86	4.89	4.93
ARRAY MASS (KG)	235.3	246.3	259.7	276.7	298.1	333.6
ARRAY WEIGHT (LB)	517.6	541.9	571.3	608.7	655.7	734.0
CENTER OF GRAVITY (IN)	726.6	721.1	716.6	707.3	686.0	656.1
TENSION PER BLANKET (LB)	2.50	7.00	15.00	27.50	42.50	70.00
MOMENT OF INERTIA I1	.4784+09	.5016+09	.5320+09	.5661+09	.5997+09	.6503+09
MOMENT OF INERTIA I2	.5737+07	.5651+07	.5549+07	.5472+07	.5421+07	.5370+07
SPECIFIC POWER (KW/KG)	.255	.244	.231	.217	.201	.180
SPECIFIC WEIGHT (KG/KW)	3.9	4.1	4.3	4.6	5.0	5.6
BLANKET - MAST CLEARANCE (IN)	13.1	12.8	13.0	12.9	12.9	12.7
* BOOM PROPERTIES *						
DIAMETER (IN)	10.55	13.81	16.79	19.61	21.93	25.14
EI (LB-IN-SQ)	.25234+07	.71735+07	.15665+08	.29172+08	.45669+08	.76487+08
ROOT SPRING (LB-IN/RAD)	.4616+05	.1010+06	.1815+06	.2894+06	.4050+06	.5962+06
BUCKLING CAPABILITY RATIO	29.78	18.21	12.56	9.35	7.57	6.04
STRENGTH CAPABILITY RATIO	1.05	2.25	3.86	5.86	7.82	11.03
* CANNISTER PROPERTIES *						
HEIGHT (IN)	39.20	42.68	46.36	49.83	52.69	56.03
DIAMETER (IN)	12.45	16.29	19.81	23.14	25.88	29.66
* WEIGHTS (LB) *						
ARRAY	517.6	541.9	571.3	608.7	655.7	734.0
BOOM	15.3	25.7	38.3	52.7	66.4	85.3
CANNISTER	16.4	28.0	41.4	56.5	70.6	92.7
TENSION MECHANISM	1.8	3.3	5.4	8.6	12.5	22.5
MAST SLEEVE	4.9	6.0	7.0	8.1	8.9	10.1
SHAFT	23.5	23.1	22.7	24.9	37.2	59.2
HEADER	3.0	3.7	4.9	6.9	9.1	13.2
DRUM BEARING	1.5	1.7	1.9	2.3	2.7	3.5
CENTER SUPPORT	35.2	34.7	34.2	33.7	33.3	32.8
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.4	11.4	11.4	11.4	11.4	11.4
LEADING EDGE MEMBERS	5.5	5.4	5.4	5.3	5.3	5.2
DRUMS	31.4	31.2	30.9	30.6	30.5	30.2
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 65.0 KW   ARRAY WIDTH = 7.00 M

BLANKET AREA = .72222+06 IN-SQ   BLANKET WEIGHT = 396.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.018	.028	.035	.043	.048
***** TORSIONAL FREQUENCY HZ *****	.010	.018	.028	.035	.043	.048
***** BENDING FREQUENCY HZ *****	.020	.034	.055	.072	.089	.103
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	117.5	115.1	112.5	109.3	107.3	105.6
ARRAY LENGTH (M)	78.09	79.66	81.56	83.95	85.52	86.85
ASPECT RATIO	11.16	11.38	11.65	11.99	12.22	12.41
ARRAY MASS (KG)	249.0	274.6	315.9	355.7	398.0	437.8
ARRAY WEIGHT (LB)	547.7	604.2	695.0	782.5	875.7	963.1
CENTER OF GRAVITY (IN)	1266.8	1245.2	1210.3	1193.5	1167.7	1147.3
TENSION PER BLANKET (LB)	2.50	7.50	20.00	35.00	55.00	75.00
MOMENT OF INERTIA I1	.1444+10	.1508+10	.1833+10	.2098+10	.2345+10	.2577+10
MOMENT OF INERTIA I2	.2593+07	.2491+07	.2378+07	.2247+07	.2171+07	.2111+07
SPECIFIC POWER (KW/KG)	.261	.237	.206	.183	.163	.148
SPECIFIC WEIGHT (KG/KW)	3.8	4.2	4.9	5.5	6.1	6.7
BLANKET - MAST CLEARANCE (IN)	12.7	12.4	12.0	12.9	12.7	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	15.29	20.46	26.63	31.28	35.57	38.74
EI (LB-IN-SQ)	.68407+07	.21357+08	.59703+08	.11069+09	.18047+09	.25386+09
ROOT SPRING (LB-IN/RAD)	.9751+05	.2290+06	.4951+06	.7867+06	.1135+07	.1466+07
BUCKLING CAPABILITY RATIO	62.48	37.30	23.70	18.68	15.38	13.38
STRENGTH CAPABILITY RATIO	1.72	3.80	7.50	10.95	14.72	17.60
* CANNISTER PROPERTIES *						
HEIGHT (IN)	51.19	56.87	63.72	69.10	73.72	77.62
DIAMETER (IN)	18.04	24.14	31.42	36.91	41.98	45.71
* WEIGHTS (LB) *						
ARRAY	547.7	604.2	695.0	782.5	875.7	963.1
BOOM	32.7	58.1	98.1	135.7	174.2	209.8
CANNISTER	33.9	60.6	102.6	141.5	183.0	217.0
TENSION MECHANISM	2.5	4.7	10.4	19.0	25.8	37.0
MAST SLEEVE	10.0	13.0	16.6	19.6	22.4	24.5
SHAFT	10.8	10.3	9.8	9.3	12.1	15.5
HEADER	2.7	3.1	3.9	4.7	5.8	6.9
DRUM BEARING	1.5	1.7	2.1	2.5	3.1	3.7
CENTER SUPPORT	18.9	18.3	17.7	17.0	16.5	16.2
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.9	11.9	11.9	11.9	11.9	11.9
LEADING EDGE MEMBERS	3.6	3.5	3.4	3.3	3.3	3.2
DRUMS	21.1	20.7	20.3	19.7	19.4	19.1
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 65.0 KW ARRAY WIDTH = 7.50 M

BLANKET AREA = .72222+06 IN-SQ BLANKET WEIGHT = 396.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.018	.029	.037	.045	.052
***** TORSIONAL FREQUENCY HZ *****	.011	.018	.029	.037	.045	.052
***** BENDING FREQUENCY HZ *****	.021	.036	.058	.076	.094	.109
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	127.6	125.4	122.9	121.1	118.2	116.8
ARRAY LENGTH (M)	71.86	73.12	74.65	75.73	77.58	78.52
ASPECT RATIO	9.58	9.75	9.95	10.10	10.34	10.47
ARRAY MASS (KG)	247.9	270.3	306.4	339.2	377.8	412.5
ARRAY WEIGHT (LB)	545.3	594.7	674.1	746.2	831.2	907.6
CENTER OF GRAVITY (IN)	1159.8	1142.3	1112.8	1088.7	1072.3	1046.4
TENSION PER BLANKET (LB)	2.50	7.50	20.00	35.00	55.00	75.00
MOMENT OF INERTIA I1	.1212+10	.1326+10	.1498+10	.1649+10	.1858+10	.2008+10
MOMENT OF INERTIA I2	.3078+07	.2971+07	.2854+07	.2777+07	.2651+07	.2597+07
SPECIFIC POWER (KW/KG)	.262	.240	.212	.192	.172	.158
SPECIFIC WEIGHT (KG/KW)	3.8	4.2	4.7	5.2	5.8	6.3
BLANKET - MAST CLEARANCE (IN)	12.8	12.6	12.3	12.1	12.9	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	14.37	19.21	24.97	28.92	33.00	36.11
EI (LB-IN-SQ)	.57923+07	.17995+08	.50004+08	.90078+08	.14854+09	.20749+09
ROOT SPRING (LB-IN/RAD)	.8607+05	.2014+06	.4335+06	.6740+06	.9809+06	.1260+07
BUCKLING CAPABILITY RATIO	55.20	32.88	20.83	15.98	13.23	11.62
STRENGTH CAPABILITY RATIO	1.57	3.49	6.94	9.96	13.48	16.58
* CANNISTER PROPERTIES *						
HEIGHT (IN)	48.94	54.22	60.56	65.30	69.91	73.06
DIAMETER (IN)	16.95	22.66	29.46	34.13	38.94	42.61
* WEIGHTS (LB) *						
ARRAY	545.3	594.7	674.1	746.2	831.2	907.6
BOOM	28.8	51.0	85.5	116.5	151.2	178.4
CANNISTER	30.0	53.5	90.4	121.3	157.8	188.9
TENSION MECHANISM	2.3	4.4	9.6	17.3	23.6	33.7
MAST SLEEVE	8.9	11.4	14.5	16.7	19.2	21.0
SHAFT	12.7	12.3	11.8	11.4	15.9	20.6
HEADER	2.8	3.2	4.1	5.2	6.5	7.8
DRUM BEARING	1.5	1.7	2.1	2.5	3.1	3.7
CENTER SUPPORT	21.4	20.8	20.2	19.8	19.1	18.7
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.9	11.9	11.9	11.9	11.9	11.9
LEADING EDGE MEMBERS	3.9	3.8	3.8	3.7	3.6	3.6
DRUMS	22.9	22.5	22.0	21.7	21.3	21.0
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 65.0 KW   ARRAY WIDTH = 8.00 M

BLANKET AREA = .72222+06 IN=SQ   BLANKET WEIGHT = 396.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.019	.030	.039	.048	.055
***** TORSIONAL FREQUENCY HZ *****	.011	.019	.030	.039	.048	.055
***** BENDING FREQUENCY HZ *****	.022	.037	.060	.079	.098	.114
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	137.8	135.7	133.2	131.6	130.0	127.7
ARRAY LENGTH (M)	66.56	67.60	68.84	69.72	70.55	71.80
ASPECT RATIO	8.32	8.45	8.60	8.71	8.82	8.98
ARRAY MASS (KG)	247.7	267.6	299.5	328.8	362.3	394.7
ARRAY WEIGHT (LB)	544.9	588.6	658.9	723.3	797.1	868.3
CENTER OF GRAVITY (IN)	1066.4	1053.3	1029.0	1007.6	980.4	966.5
TENSION PER BLANKET (LB)	2.50	7.50	20.00	35.00	55.00	75.00
MOMENT OF INERTIA I1	.1032+10	.1120+10	.1250+10	.1364+10	.1485+10	.1626+10
MOMENT OF INERTIA I2	.3605+07	.3494+07	.3373+07	.3294+07	.3226+07	.3124+07
SPECIFIC POWER (KW/KG)	.262	.243	.217	.198	.179	.165
SPECIFIC WEIGHT (KG/KW)	3.8	4.1	4.6	5.1	5.6	6.1
BLANKET - MAST CLEARANCE (IN)	12.9	12.7	12.5	12.3	12.0	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	13.64	18.09	23.49	27.19	30.83	33.61
EI (LB-IN-SQ)	.49698+07	.15377+08	.42522+08	.76333+08	.12282+09	.17349+09
ROOT SPRING (LB-IN/RAD)	.7673+05	.1790+06	.3839+06	.5953+06	.8505+06	.1102+07
BUCKLING CAPABILITY RATIO	49.74	29.17	18.44	14.12	11.55	10.07
STRENGTH CAPABILITY RATIO	1.46	3.19	6.39	9.22	12.54	15.13
* CANNISTER PROPERTIES *						
HEIGHT (IN)	46.67	52.02	57.95	62.38	66.14	69.74
DIAMETER (IN)	16.09	21.35	27.72	32.08	36.38	39.66
* WEIGHTS (LB) *						
ARRAY	544.9	588.6	658.9	723.3	797.1	868.3
BOOM	25.4	45.4	75.8	102.8	130.2	157.5
CANNISTER	27.1	47.6	80.2	107.4	138.0	164.1
TENSION MECHANISM	2.2	4.2	9.0	16.1	21.6	31.1
MAST SLEEVE	7.9	10.1	12.8	14.7	16.5	18.2
SHAFT	14.9	14.4	13.9	14.1	20.9	26.7
HEADER	2.8	3.3	4.4	5.7	7.4	8.9
DRUM BEARING	1.5	1.7	2.1	2.5	3.1	3.7
CENTER SUPPORT	24.2	23.6	22.9	22.4	22.0	21.4
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.9	11.9	11.9	11.9	11.9	11.9
LEADING EDGE MEMBERS	4.2	4.2	4.1	4.0	4.0	3.9
DRUMS	24.6	24.2	23.8	23.5	23.3	22.9
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 65.0 KW ARRAY WIDTH = 8.50 M

BLANKET AREA = .72222+06 IN-SQ BLANKET WEIGHT = 396.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.012	.020	.032	.041	.050	.057
***** TORSIONAL FREQUENCY HZ *****	.012	.020	.032	.041	.050	.057
***** BENDING FREQUENCY HZ *****	.022	.038	.062	.082	.102	.119
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	147.9	145.9	143.6	142.0	140.5	139.4
ARRAY LENGTH (M)	62.00	62.86	63.88	64.61	65.29	65.81
ASPECT RATIO	7.29	7.40	7.52	7.60	7.68	7.74
ARRAY MASS (KG)	248.2	266.1	294.6	321.4	352.5	381.4
ARRAY WEIGHT (LB)	546.1	585.3	648.2	707.1	775.6	839.1
CENTER OF GRAVITY (IN)	985.6	974.3	955.7	934.0	910.4	888.4
TENSION PER BLANKET (LB)	2.50	7.50	20.00	35.00	55.00	75.00
MOMENT OF INERTIA I1	.8914+09	.9586+09	.1061+10	.1148+10	.1244+10	.1328+10
MOMENT OF INERTIA I2	.4175+07	.4061+07	.3936+07	.3856+07	.3787+07	.3741+07
SPECIFIC POWER (KW/KG)	.262	.244	.221	.202	.184	.170
SPECIFIC WEIGHT (KG/KW)	3.8	4.1	4.5	4.9	5.4	5.9
BLANKET - MAST CLEARANCE (IN)	12.9	12.8	12.7	12.4	12.3	12.2
* BOOM PROPERTIES *						
DIAMETER (IN)	12.89	17.20	22.16	25.81	29.05	31.52
EI (LB-IN-SQ)	.43123+07	.13297+08	.36623+08	.65555+08	.10519+09	.14575+09
ROOT SPRING (LB-IN/RAD)	.6899+05	.1605+06	.3432+06	.5311+06	.7572+06	.9670+06
BUCKLING CAPABILITY RATIO	44.42	26.37	16.41	12.73	10.26	8.86
STRENGTH CAPABILITY RATIO	1.33	2.98	5.87	8.71	11.61	14.05
* CANNISTER PROPERTIES *						
HEIGHT (IN)	45.14	49.81	55.76	59.57	63.45	66.41
DIAMETER (IN)	15.21	20.30	26.15	30.46	34.28	37.19
* WEIGHTS (LB) *						
ARRAY	546.1	585.3	648.2	707.1	775.6	839.1
BOOM	23.0	40.4	68.1	90.8	116.2	137.9
CANNISTER	24.2	43.1	71.5	97.0	122.8	144.6
TENSION MECHANISM	2.1	3.9	8.4	15.1	20.2	28.8
MAST SLEEVE	7.1	9.1	11.4	13.1	14.6	15.8
SHAFT	17.2	16.7	16.2	17.4	26.1	34.4
HEADER	2.8	3.4	4.7	6.2	8.2	10.1
DRUM BEARING	1.5	1.7	2.1	2.5	3.1	3.7
CENTER SUPPORT	27.1	26.5	25.8	25.4	24.9	24.6
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.9	11.9	11.9	11.9	11.9	11.9
LEADING EDGE MEMBERS	4.5	4.5	4.4	4.3	4.3	4.3
DRUMS	26.3	26.0	25.6	25.3	25.0	24.8
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 65.0 KW   ARRAY WIDTH = 9.00 M

BLANKET AREA = .72222+06 IN-SQ   BLANKET WEIGHT = 396.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.012	.021	.033	.043	.052	.060
***** TORSIONAL FREQUENCY HZ *****	.012	.021	.033	.043	.052	.060
***** BENDING FREQUENCY HZ *****	.023	.040	.064	.085	.106	.123
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	158.0	156.1	153.9	152.3	150.9	149.8
ARRAY LENGTH (M)	58.04	58.75	59.61	60.21	60.78	61.21
ASPECT RATIO	6.45	6.53	6.62	6.69	6.75	6.80
ARRAY MASS (KG)	249.4	265.5	291.4	316.3	345.8	373.3
ARRAY WEIGHT (LB)	548.7	584.1	641.0	695.9	760.9	821.3
CENTER OF GRAVITY (IN)	913.6	905.6	889.3	871.0	845.7	824.2
TENSION PER BLANKET (LB)	2.50	7.50	20.00	35.00	55.00	75.00
MOMENT OF INERTIA I1	.7778+09	.8319+09	.9123+09	.9832+09	.1058+10	.1125+10
MOMENT OF INERTIA I2	.4789+07	.4672+07	.4543+07	.4462+07	.4394+07	.4350+07
SPECIFIC POWER (KW/KG)	.261	.245	.223	.206	.188	.174
SPECIFIC WEIGHT (KG/KW)	3.8	4.1	4.5	4.9	5.3	5.7
BLANKET - MAST CLEARANCE (IN)	13.0	12.9	12.7	12.6	12.4	12.3
* BOOM PROPERTIES *						
DIAMETER (IN)	12.29	16.28	21.10	24.40	27.64	29.97
EI (LB-IN-SQ)	.37782+07	.11617+08	.31887+08	.56941+08	.91166+08	.12610+09
ROOT SPRING (LB-IN/RAD)	.6247+05	.1451+06	.3093+06	.4779+06	.6801+06	.8675+06
BUCKLING CAPABILITY RATIO	40.41	23.62	14.89	11.37	9.28	8.01
STRENGTH CAPABILITY RATIO	1.24	2.73	5.51	8.01	10.97	13.30
* CANNISTER PROPERTIES *						
HEIGHT (IN)	43.47	48.29	53.56	57.52	60.83	63.63
DIAMETER (IN)	14.51	19.21	24.90	28.79	32.61	35.37
* WEIGHTS (LB) *						
ARRAY	548.7	584.1	641.0	695.9	760.9	821.3
BOOM	20.7	36.8	61.0	82.3	103.6	122.7
CANNISTER	22.1	38.7	65.0	86.8	111.3	130.9
TENSION MECHANISM	2.0	3.8	8.0	14.2	19.0	27.0
MAST SLEEVE	6.5	8.2	10.3	11.7	13.1	14.2
SHAFT	19.7	19.2	18.7	21.3	32.1	42.5
HEADER	2.9	3.5	5.0	6.8	9.0	11.3
DRUM BEARING	1.5	1.7	2.1	2.5	3.1	3.7
CENTER SUPPORT	30.3	29.7	29.0	28.5	28.1	27.7
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.9	11.9	11.9	11.9	11.9	11.9
LEADING EDGE MEMBERS	4.8	4.8	4.7	4.7	4.6	4.6
DRUMS	28.0	27.7	27.3	27.0	26.8	26.6
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 65.0 KW ARRAY WIDTH = 9.50 M

BLANKET AREA = .72222+06 IN-SQ BLANKET WEIGHT = 396.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.013	.021	.034	.044	.054	.062
***** TORSIONAL FREQUENCY HZ *****	.013	.021	.034	.044	.054	.062
***** BENDING FREQUENCY HZ *****	.024	.041	.067	.088	.109	.127
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	168.3	166.3	164.1	162.7	161.3	160.3
ARRAY LENGTH (M)	54.50	55.16	55.88	56.39	56.87	57.23
ASPECT RATIO	5.74	5.81	5.88	5.94	5.99	6.02
ARRAY MASS (KG)	251.2	265.8	289.3	313.1	341.6	368.3
ARRAY WEIGHT (LB)	552.6	584.7	636.5	688.8	751.5	810.3
CENTER OF GRAVITY (IN)	848.6	843.4	830.2	812.5	789.9	766.7
TENSION PER BLANKET (LB)	2.50	7.50	20.00	35.00	55.00	75.00
MOMENT OF INERTIA I1	.6837+09	.7288+09	.7941+09	.8518+09	.9152+09	.9681+09
MOMENT OF INERTIA I2	.5458+07	.5327+07	.5196+07	.5115+07	.5049+07	.5007+07
SPECIFIC POWER (KW/KG)	.259	.245	.225	.208	.190	.176
SPECIFIC WEIGHT (KG/KW)	3.9	4.1	4.5	4.8	5.3	5.7
BLANKET - MAST CLEARANCE (IN)	12.8	13.0	12.8	12.7	12.6	12.5
* BOOM PROPERTIES *						
DIAMETER (IN)	11.74	15.55	20.14	23.27	26.17	28.57
EI (LB-IN-SQ)	.33316+07	.10240+08	.28025+08	.49942+08	.79808+08	.11023+09
ROOT SPRING (LB-IN/RAD)	.5685+05	.1320+06	.2808+06	.4331+06	.6155+06	.7842+06
BUCKLING CAPABILITY RATIO	36.86	21.54	13.56	10.34	8.32	7.28
STRENGTH CAPABILITY RATIO	1.15	2.55	5.17	7.53	10.09	12.55
* CANNISTER PROPERTIES *						
HEIGHT (IN)	41.99	46.63	51.65	55.43	58.92	61.22
DIAMETER (IN)	13.85	18.34	23.77	27.46	30.88	33.71
* WEIGHTS (LB) *						
ARRAY	552.6	584.7	636.5	688.8	751.5	810.3
BOOM	18.8	33.4	55.1	74.3	94.7	110.4
CANNISTER	20.2	35.4	59.3	79.1	100.0	119.2
TENSION MECHANISM	2.0	3.6	7.6	13.4	17.9	25.5
MAST SLEEVE	5.9	7.5	9.3	10.6	11.8	12.8
SHAFT	22.4	21.9	21.3	25.8	39.0	51.8
HEADER	2.9	3.6	5.3	7.3	10.0	12.5
DRUM BEARING	1.5	1.7	2.1	2.5	3.1	3.7
CENTER SUPPORT	33.8	33.1	32.4	31.9	31.4	31.1
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.9	11.9	11.9	11.9	11.9	11.9
LEADING EDGE MEMBERS	5.1	5.1	5.0	5.0	4.9	4.9
DRUMS	29.7	29.4	29.0	28.8	28.6	28.4
LATCHES	.3	.3	.3	.3	.3	.3

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE GE ROLLOUT POWER/WING = 65.0 KW ARRAY WIDTH = 10.00 M

BLANKET AREA = .72222+06 IN-SQ BLANKET WEIGHT = 396.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.013	.022	.035	.046	.056	.064
***** TORSIONAL FREQUENCY HZ *****	.013	.022	.035	.046	.056	.064
***** BENDING FREQUENCY HZ *****	.025	.042	.069	.090	.113	.131
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	178.2	177.2	174.4	172.9	171.6	170.7
ARRAY LENGTH (M)	51.47	51.77	52.60	53.04	53.44	53.75
ASPECT RATIO	5.15	5.18	5.26	5.30	5.34	5.37
ARRAY MASS (KG)	253.3	266.8	288.4	311.4	339.5	365.9
ARRAY WEIGHT (LB)	557.3	587.0	634.4	685.1	746.8	804.9
CENTER OF GRAVITY (IN)	792.3	783.7	777.2	759.7	737.2	716.4
TENSION PER BLANKET (LB)	2.50	7.50	20.00	35.00	55.00	75.00
MOMENT OF INERTIA I1	.6085+09	.6388+09	.6984+09	.7466+09	.7997+09	.8465+09
MOMENT OF INERTIA I2	.6149+07	.6079+07	.5893+07	.5814+07	.5751+07	.5712+07
SPECIFIC POWER (KW/KG)	.257	.244	.225	.209	.191	.178
SPECIFIC WEIGHT (KG/KW)	3.9	4.1	4.4	4.8	5.2	5.6
BLANKET - MAST CLEARANCE (IN)	13.0	12.3	12.9	12.8	12.7	12.7
* BOOM PROPERTIES *						
DIAMETER (IN)	11.24	14.84	19.26	22.24	25.00	27.09
EI (LB-IN-SQ)	.29715+07	.90203+07	.24832+08	.44175+08	.70477+08	.97217+08
ROOT SPRING (LB-IN/RAD)	.5218+05	.1200+06	.2564+06	.3950+06	.5607+06	.7137+06
BUCKLING CAPABILITY RATIO	33.81	19.63	12.40	9.45	7.59	6.54
STRENGTH CAPABILITY RATIO	1.08	2.38	4.84	7.07	9.49	11.53
* CANNISTER PROPERTIES *						
HEIGHT (IN)	40.78	45.05	49.99	53.61	56.94	59.48
DIAMETER (IN)	13.27	17.51	22.73	26.25	29.50	31.97
* WEIGHTS (LB) *						
ARRAY	557.3	587.0	634.4	685.1	746.8	804.9
BOOM	17.3	30.3	50.3	67.6	86.1	101.7
CANNISTER	18.5	32.3	54.3	72.4	91.5	107.4
TENSION MECHANISM	1.9	3.4	7.2	12.8	17.0	24.1
MAST SLEEVE	5.5	6.8	8.5	9.7	10.7	11.6
SHAFT	25.2	24.9	24.1	30.8	46.8	62.4
HEADER	3.0	3.8	5.7	8.0	10.9	13.9
DRUM BEARING	1.5	1.7	2.1	2.5	3.1	3.7
CENTER SUPPORT	37.4	37.0	36.0	35.5	35.0	34.7
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	11.9	11.9	11.9	11.9	11.9	11.9
LEADING EDGE MEMBERS	5.5	5.4	5.3	5.3	5.3	5.2
DRUMS	31.4	31.2	30.8	30.5	30.3	30.1
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 70.0 KW   ARRAY WIDTH = 7.00 M

BLANKET AREA = .77778+06 IN-SQ   BLANKET WEIGHT = 427.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.019	.026	.033	.041	.050
***** TORSIONAL FREQUENCY HZ *****	.010	.019	.026	.033	.041	.050
***** BENDING FREQUENCY HZ *****	.018	.036	.053	.069	.088	.109
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	117.0	113.8	110.4	108.0	105.3	102.7
ARRAY LENGTH (M)	84.41	86.80	89.48	91.48	93.77	96.15
ASPECT RATIO	12.06	12.40	12.78	13.07	13.40	13.74
ARRAY MASS (KG)	268.1	308.1	349.6	394.8	454.9	529.2
ARRAY WEIGHT (LB)	589.8	677.7	769.1	868.6	1000.9	1164.2
CENTER OF GRAVITY (IN)	1372.1	1339.6	1317.3	1292.0	1260.5	1226.6
TENSION PER BLANKET (LB)	2.50	10.00	21.50	37.50	63.00	100.00
MOMENT OF INERTIA I1	.1819+10	.2100+10	.2419+10	.2744+10	.3170+10	.3694+10
MOMENT OF INERTIA I2	.2760+07	.2610+07	.2456+07	.2354+07	.2247+07	.2147+07
SPECIFIC POWER (KW/KG)	.261	.227	.200	.177	.154	.132
SPECIFIC WEIGHT (KG/KW)	3.8	4.4	5.0	5.6	6.5	7.6
BLANKET - MAST CLEARANCE (IN)	12.7	12.3	12.8	12.9	12.8	12.6
* BOOM PROPERTIES *						
DIAMETER (IN)	16.21	23.40	29.15	33.87	39.29	44.95
EI (LB-IN-SQ)	.79923+07	.33803+08	.77250+08	.14081+09	.24858+09	.41482+09
ROOT SPRING (LB-IN/RAD)	.1096+06	.3232+06	.6007+06	.9423+06	.1443+07	.2119+07
BUCKLING CAPABILITY RATIO	70.28	36.61	26.42	20.45	16.38	13.51
STRENGTH CAPABILITY RATIO	1.76	4.72	8.18	11.58	16.08	21.23
* CANNISTER PROPERTIES *						
HEIGHT (IN)	53.35	61.42	67.45	73.22	79.23	85.47
DIAMETER (IN)	19.13	27.62	34.40	39.97	46.37	53.04
* WEIGHTS (LB) *						
ARRAY	589.8	677.7	769.1	868.6	1000.9	1164.2
BOOM	36.7	76.5	116.2	160.4	215.6	282.0
CANNISTER	38.0	79.2	122.7	165.7	222.9	291.4
TENSION MECHANISM	2.6	6.4	11.8	21.1	32.8	49.4
MAST SLEEVE	11.3	15.7	19.6	22.8	26.7	30.9
SHAFT	11.5	10.8	10.2	9.7	13.1	18.8
HEADER	2.7	3.2	3.9	4.8	6.2	8.0
DRUM BEARING	1.5	1.8	2.1	2.6	3.3	4.4
CENTER SUPPORT	19.8	19.0	18.1	17.6	16.9	16.4
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	12.3	12.3	12.3	12.3	12.3	12.3
LEADING EDGE MEMBERS	3.6	3.5	3.4	3.3	3.2	3.1
DRUMS	21.1	20.6	20.0	19.6	19.2	18.7
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 70.0 KW ARRAY WIDTH = 7.50 M

BLANKET AREA = .77778+06 IN=SQ BLANKET WEIGHT = 427.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.020	.028	.035	.044	.053
***** TORSIONAL FREQUENCY HZ *****	.010	.020	.028	.035	.044	.053
***** BENDING FREQUENCY HZ *****	.019	.038	.055	.072	.092	.115
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	127.2	124.2	122.0	119.0	116.6	114.0
ARRAY LENGTH (M)	77.64	79.56	81.00	83.01	84.75	86.63
ASPECT RATIO	10.35	10.61	10.80	11.07	11.30	11.55
ARRAY MASS (KG)	266.6	301.5	336.4	376.0	428.5	493.2
ARRAY WEIGHT (LB)	586.5	663.3	740.0	827.2	942.6	1085.0
CENTER OF GRAVITY (IN)	1256.2	1229.4	1202.0	1183.2	1154.1	1122.0
TENSION PER BLANKET (LB)	2.50	10.00	21.50	37.50	63.00	100.00
MOMENT OF INERTIA I1	.1524+10	.1731+10	.1925+10	.2175+10	.2475+10	.2840+10
MOMENT OF INERTIA I2	.3277+07	.3121+07	.3013+07	.2872+07	.2765+07	.2659+07
SPECIFIC POWER (KW/KG)	.263	.232	.208	.186	.163	.142
SPECIFIC WEIGHT (KG/KW)	3.8	4.3	4.8	5.4	6.1	7.0
BLANKET - MAST CLEARANCE (IN)	12.8	12.5	12.2	12.8	12.9	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	15.24	21.97	27.02	31.64	36.40	41.58
EI (LB-IN-SQ)	.67615+07	.28399+08	.63290+08	.11595+09	.20303+09	.33671+09
ROOT SPRING (LB-IN/RAD)	.9666+05	.2836+06	.5173+06	.8146+06	.1240+07	.1812+07
BUCKLING CAPABILITY RATIO	62.12	32.26	22.70	17.85	14.06	11.56
STRENGTH CAPABILITY RATIO	1.61	4.35	7.41	10.82	14.82	19.74
* CANNISTER PROPERTIES *						
HEIGHT (IN)	50.94	58.44	63.88	69.08	74.86	80.52
DIAMETER (IN)	17.99	25.92	31.88	37.34	42.95	49.06
* WEIGHTS (LB) *						
ARRAY	586.5	663.3	740.0	827.2	942.6	1085.0
BOOM	32.3	66.9	100.3	137.3	185.5	241.0
CANNISTER	33.7	69.9	105.7	144.8	191.6	249.9
TENSION MECHANISM	2.4	5.9	10.8	19.2	29.8	44.7
MAST SLEEVE	10.0	13.8	16.7	19.6	22.7	26.1
SHAFT	13.6	12.9	12.5	11.9	17.4	25.4
HEADER	2.8	3.4	4.2	5.3	7.0	9.3
DRUM BEARING	1.5	1.8	2.1	2.6	3.3	4.4
CENTER SUPPORT	22.5	21.6	21.0	20.3	19.6	19.0
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	12.3	12.3	12.3	12.3	12.3	12.3
LEADING EDGE MEMBERS	3.9	3.8	3.7	3.6	3.6	3.5
DRUMS	22.9	22.4	22.0	21.5	21.1	20.6
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT　　POWER/WING = 70.0 KW　　ARRAY WIDTH = 8.00 M

BLANKET AREA = .77778+06 IN=SQ　　BLANKET WEIGHT = 427.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.020	.029	.037	.047	.057
***** TORSIONAL FREQUENCY HZ *****	.011	.020	.029	.037	.047	.057
***** BENDING FREQUENCY HZ *****	.020	.040	.058	.075	.097	.121
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	137.5	134.5	132.4	130.7	127.5	125.3
ARRAY LENGTH (M)	71.86	73.42	74.58	75.60	77.47	78.84
ASPECT RATIO	8.98	9.18	9.32	9.45	9.68	9.86
ARRAY MASS (KG)	266.1	297.0	327.8	361.4	409.6	467.3
ARRAY WEIGHT (LB)	585.5	653.4	721.1	795.2	901.1	1028.0
CENTER OF GRAVITY (IN)	1155.5	1133.8	1110.7	1087.6	1062.3	1028.2
TENSION PER BLANKET (LB)	2.50	10.00	21.50	37.50	63.00	100.00
MOMENT OF INERTIA I1	.1296+10	.1452+10	.1598+10	.1753+10	.1995+10	.2251+10
MOMENT OF INERTIA I2	.3843+07	.3681+07	.3570+07	.3481+07	.3326+07	.3228+07
SPECIFIC POWER (KW/KG)	.263	.236	.214	.194	.171	.150
SPECIFIC WEIGHT (KG/KW)	3.8	4.2	4.7	5.2	5.9	6.7
BLANKET - MAST CLEARANCE (IN)	12.8	12.6	12.3	12.1	12.9	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	14.37	20.68	25.41	29.40	34.11	38.89
EI (LB=IN=SQ)	.57931+07	.24186+08	.53658+08	.96180+08	.16965+09	.27893+09
ROOT SPRING (LB=IN/RAD)	.8608+05	.2514+06	.4570+06	.7080+06	.1084+07	.1573+07
BUCKLING CAPABILITY RATIO	55.21	28.59	20.08	15.41	12.35	10.11
STRENGTH CAPABILITY RATIO	1.47	3.99	6.85	9.83	13.87	18.60
* CANNISTER PROPERTIES *						
HEIGHT (IN)	48.94	55.94	61.01	65.76	71.06	76.16
DIAMETER (IN)	16.95	24.40	29.98	34.69	40.25	45.89
* WEIGHTS (LB) *						
ARRAY	585.5	653.4	721.1	795.2	901.1	1028.0
BOOM	28.8	59.3	88.5	120.2	161.3	207.7
CANNISTER	30.0	62.1	93.6	125.4	168.6	219.0
TENSION MECHANISM	2.3	5.6	10.1	17.7	27.4	41.0
MAST SLEEVE	8.9	12.2	14.7	16.9	19.7	22.5
SHAFT	15.9	15.2	14.7	14.7	22.5	33.4
HEADER	2.8	3.5	4.5	5.9	7.9	10.7
DRUM BEARING	1.5	1.8	2.1	2.6	3.3	4.4
CENTER SUPPORT	25.4	24.6	24.0	23.4	22.6	21.9
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	12.3	12.3	12.3	12.3	12.3	12.3
LEADING EDGE MEMBERS	4.2	4.1	4.1	4.0	3.9	3.8
DRUMS	24.6	24.1	23.8	23.5	22.9	22.5
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 70.0 KW ARRAY WIDTH = 8.50 M

BLANKET AREA = .77778+06 IN=SQ BLANKET WEIGHT = 427.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.021	.030	.039	.049	.060
***** TORSIONAL FREQUENCY HZ *****	.011	.021	.030	.039	.049	.060
***** BENDING FREQUENCY HZ *****	.021	.041	.060	.078	.101	.126
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	147.6	144.8	142.8	141.1	139.3	136.3
ARRAY LENGTH (M)	66.92	68.21	69.17	70.01	70.93	72.50
ASPECT RATIO	7.87	8.02	8.14	8.24	8.34	8.53
ARRAY MASS (KG)	266.5	294.1	321.6	352.2	395.1	449.2
ARRAY WEIGHT (LB)	586.4	647.1	707.5	774.9	869.3	988.2
CENTER OF GRAVITY (IN)	1067.2	1049.3	1031.7	1010.8	976.3	949.5
TENSION PER BLANKET (LB)	2.50	10.00	21.50	37.50	63.00	100.00
MOMENT OF INERTIA I1	.1117+10	.1238+10	.1352+10	.1473+10	.1623+10	.1843+10
MOMENT OF INERTIA I2	.4452+07	.4285+07	.4171+07	.4079+07	.3990+07	.3840+07
SPECIFIC POWER (KW/KG)	.263	.238	.218	.199	.177	.156
SPECIFIC WEIGHT (KG/KW)	3.8	4.2	4.6	5.0	5.6	6.4
BLANKET - MAST CLEARANCE (IN)	12.9	12.7	12.5	12.4	12.1	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	13.68	19.66	23.97	27.72	31.98	36.54
EI (LB=IN=SQ)	.50240+07	.20876+08	.46154+08	.82472+08	.14222+09	.23583+09
ROOT SPRING (LB=IN/RAD)	.7736+05	.2251+06	.4082+06	.6309+06	.9494+06	.1387+07
BUCKLING CAPABILITY RATIO	50.01	25.84	17.87	13.70	10.85	8.93
STRENGTH CAPABILITY RATIO	1.37	3.74	6.31	9.09	12.89	17.39
* CANNISTER PROPERTIES *						
HEIGHT (IN)	46.89	53.49	58.63	63.10	67.57	72.62
DIAMETER (IN)	16.14	23.20	28.29	32.71	37.74	43.12
* WEIGHTS (LB) *						
ARRAY	586.4	647.1	707.5	774.9	869.3	988.2
BOOM	25.7	52.6	79.3	107.3	140.9	182.9
CANNISTER	27.2	56.2	83.5	111.6	148.5	193.8
TENSION MECHANISM	2.2	5.2	9.4	16.5	25.3	37.9
MAST SLEEVE	8.0	10.9	13.1	15.0	17.2	19.7
SHAFT	18.4	17.7	17.2	18.3	29.0	42.6
HEADER	2.8	3.6	4.8	6.4	8.9	12.2
DRUM BEARING	1.5	1.8	2.1	2.6	3.3	4.4
CENTER SUPPORT	28.6	27.7	27.1	26.6	26.0	25.1
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	12.3	12.3	12.3	12.3	12.3	12.3
LEADING EDGE MEMBERS	4.5	4.4	4.4	4.3	4.3	4.2
DRUMS	26.3	25.9	25.5	25.2	24.9	24.4
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 70.0 KW ARRAY WIDTH = 9.00 M

BLANKET AREA = .77778+06 IN-SQ BLANKET WEIGHT = 427.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.022	.032	.041	.051	.063
***** TORSIONAL FREQUENCY HZ *****	.011	.022	.032	.041	.051	.063
***** BENDING FREQUENCY HZ *****	.021	.042	.062	.081	.105	.131
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	157.7	155.1	153.1	151.5	149.7	148.0
ARRAY LENGTH (M)	62.63	63.71	64.50	65.21	65.97	66.76
ASPECT RATIO	6.96	7.08	7.17	7.25	7.33	7.42
ARRAY MASS (KG)	267.6	292.5	317.3	345.7	386.1	435.9
ARRAY WEIGHT (LB)	588.7	643.4	698.0	760.5	849.5	959.0
CENTER OF GRAVITY (IN)	989.3	976.1	960.2	940.4	909.6	874.7
TENSION PER BLANKET (LB)	2.50	10.00	21.50	37.50	63.00	100.00
MOMENT OF INERTIA I1	.9739+09	.1070+10	.1159+10	.1255+10	.1378+10	.1523+10
MOMENT OF INERTIA I2	.5107+07	.4936+07	.4818+07	.4726+07	.4637+07	.4557+07
SPECIFIC POWER (KW/KG)	.262	.239	.221	.202	.181	.161
SPECIFIC WEIGHT (KG/KW)	3.8	4.2	4.5	4.9	5.5	6.2
BLANKET - MAST CLEARANCE (IN)	12.9	12.8	12.6	12.5	12.3	12.0
* BOOM PROPERTIES *						
DIAMETER (IN)	13.05	18.61	22.83	26.38	30.21	34.35
EI (LB-IN-SQ)	.43998+07	.18210+08	.40140+08	.71542+08	.12303+09	.19997+09
ROOT SPRING (LB-IN/RAD)	.7003+05	.2032+06	.3676+06	.5671+06	.8516+06	.1226+07
BUCKLING CAPABILITY RATIO	45.51	23.15	16.21	12.41	9.69	7.89
STRENGTH CAPABILITY RATIO	1.27	3.43	5.94	8.59	11.93	16.16
* CANNISTER PROPERTIES *						
HEIGHT (IN)	45.12	51.77	56.26	60.49	65.05	69.36
DIAMETER (IN)	15.39	21.96	26.94	31.13	35.65	40.53
* WEIGHTS (LB) *						
ARRAY	588.7	643.4	698.0	760.5	849.5	959.0
BOOM	23.1	47.9	70.9	95.7	127.0	161.6
CANNISTER	24.8	50.4	75.9	101.3	132.8	171.6
TENSION MECHANISM	2.1	5.0	8.9	15.5	23.7	35.2
MAST SLEEVE	7.3	9.8	11.8	13.4	15.3	17.3
SHAFT	21.0	20.3	19.8	22.4	35.8	54.3
HEADER	2.9	3.8	5.2	7.0	9.9	13.9
DRUM BEARING	1.5	1.8	2.1	2.6	3.3	4.4
CENTER SUPPORT	32.1	31.1	30.5	29.9	29.3	28.7
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	12.3	12.3	12.3	12.3	12.3	12.3
LEADING EDGE MEMBERS	4.8	4.7	4.7	4.6	4.6	4.5
DRUMS	28.0	27.6	27.3	27.0	26.7	26.4
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 70.0 KW   ARRAY WIDTH = 9.50 M

BLANKET AREA = .77778+06 IN-SQ   BLANKET WEIGHT = 427.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.012	.023	.033	.042	.053	.065
***** TORSIONAL FREQUENCY HZ *****	.012	.023	.033	.042	.053	.065
***** BENDING FREQUENCY HZ *****	.022	.044	.064	.084	.108	.136
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	168.3	165.3	163.4	161.8	160.2	158.5
ARRAY LENGTH (M)	58.69	59.77	60.44	61.03	61.68	62.34
ASPECT RATIO	6.18	6.29	6.36	6.42	6.49	6.56
ARRAY MASS (KG)	269.3	291.9	314.4	341.4	380.2	428.4
ARRAY WEIGHT (LB)	592.6	642.1	691.7	751.0	836.4	942.4
CENTER OF GRAVITY (IN)	917.5	909.6	898.2	877.5	847.1	815.3
TENSION PER BLANKET (LB)	2.50	10.00	21.50	37.50	63.00	100.00
MOMENT OF INERTIA I1	.8526+09	.9347+09	.1008+10	.1084+10	.1184+10	.1306+10
MOMENT OF INERTIA I2	.5843+07	.5633+07	.5514+07	.5421+07	.5334+07	.5259+07
SPECIFIC POWER (KW/KG)	.260	.240	.223	.205	.184	.163
SPECIFIC WEIGHT (KG/KW)	3.8	4.2	4.5	4.9	5.4	6.1
BLANKET - MAST CLEARANCE (IN)	12.5	12.9	12.8	12.6	12.4	12.3
* BOOM PROPERTIES *						
DIAMETER (IN)	12.36	17.77	21.64	25.17	28.80	32.50
EI (LB-IN-SQ)	.38639+07	.16029+08	.35245+08	.62680+08	.10753+09	.17435+09
ROOT SPRING (LB-IN/RAD)	.6353+05	.1847+06	.3335+06	.5135+06	.7698+06	.1106+07
BUCKLING CAPABILITY RATIO	40.87	21.11	14.56	11.29	8.80	7.06
STRENGTH CAPABILITY RATIO	1.16	3.21	5.45	8.09	11.28	14.94
* CANNISTER PROPERTIES *						
HEIGHT (IN)	43.88	49.94	54.58	58.23	62.56	66.98
DIAMETER (IN)	14.59	20.97	25.53	29.70	33.99	38.35
* WEIGHTS (LB) *						
ARRAY	592.6	642.1	691.7	751.0	836.4	942.4
BOOM	21.2	43.3	65.0	86.3	114.2	147.0
CANNISTER	22.3	46.1	68.3	92.3	120.9	154.0
TENSION MECHANISM	2.0	4.7	8.4	14.7	22.4	33.2
MAST SLEEVE	6.6	8.9	10.6	12.2	13.8	15.5
SHAFT	24.0	23.2	22.6	27.1	43.6	66.5
HEADER	2.9	4.0	5.5	7.6	10.9	15.5
DRUM BEARING	1.5	1.8	2.1	2.6	3.3	4.4
CENTER SUPPORT	35.9	34.8	34.1	33.5	32.9	32.3
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	12.3	12.3	12.3	12.3	12.3	12.3
LEADING EDGE MEMBERS	5.1	5.1	5.0	5.0	4.9	4.8
DRUMS	29.8	29.3	29.0	28.7	28.5	28.2
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 70.0 KW   ARRAY WIDTH = 10.00 M

BLANKET AREA = .7777E+06 IN=SQ   BLANKET WEIGHT = 427.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.012	.023	.034	.044	.055	.067
***** TORSIONAL FREQUENCY HZ *****	.012	.023	.034	.044	.055	.067
***** BENDING FREQUENCY HZ *****	.023	.045	.066	.087	.112	.140
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	177.2	175.4	173.6	172.1	170.4	168.8
ARRAY LENGTH (M)	55.75	56.32	56.90	57.40	57.95	58.52
ASPECT RATIO	5.58	5.63	5.69	5.74	5.80	5.85
ARRAY MASS (KG)	271.3	292.1	312.8	338.8	376.8	424.3
ARRAY WEIGHT (LB)	596.8	642.7	688.2	745.4	828.9	933.5
CENTER OF GRAVITY (IN)	862.6	850.4	841.5	821.2	791.2	759.4
TENSION PER BLANKET (LB)	2.50	10.00	21.50	37.50	63.00	100.00
MOMENT OF INERTIA I1	.7674+09	.8250+09	.8860+09	.9490+09	.1033+10	.1135+10
MOMENT OF INERTIA I2	.6501+07	.6374+07	.6252+07	.6160+07	.6076+07	.6005+07
SPECIFIC POWER (KW/KG)	.258	.240	.224	.207	.186	.165
SPECIFIC WEIGHT (KG/KW)	3.9	4.2	4.5	4.8	5.4	6.1
BLANKET - MAST CLEARANCE (IN)	13.7	13.0	12.9	12.7	12.6	12.5
* BOOM PROPERTIES *						
DIAMETER (IN)	11.96	17.00	20.69	24.06	27.52	31.04
EI (LB-IN-SQ)	.34871+07	.14232+08	.31231+08	.55445+08	.94937+08	.15364+09
ROOT SPRING (LB-IN/RAD)	.5883+05	.1689+06	.3046+06	.4684+06	.7011+06	.1006+07
BUCKLING CAPABILITY RATIO	38.27	19.33	13.32	10.32	8.04	6.44
STRENGTH CAPABILITY RATIO	1.11	3.01	5.12	7.61	10.63	14.11
* CANNISTER PROPERTIES *						
HEIGHT (IN)	42.41	48.36	52.80	56.28	60.42	64.64
DIAMETER (IN)	14.12	20.06	24.42	28.39	32.48	36.63
* WEIGHTS (LB) *						
ARRAY	596.8	642.7	688.2	745.4	828.9	933.5
BOOM	19.4	39.6	59.3	78.5	103.7	133.2
CANNISTER	20.9	42.2	62.6	84.5	110.6	140.7
TENSION MECHANISM	2.0	4.5	8.0	13.9	21.2	31.4
MAST SLEEVE	6.1	8.2	9.7	11.1	12.6	14.1
SHAFT	26.7	26.2	25.6	32.4	52.4	80.2
HEADER	3.0	4.1	5.9	8.3	12.0	17.3
DRUM BEARING	1.5	1.8	2.1	2.6	3.3	4.4
CENTER SUPPORT	39.3	38.6	37.9	37.3	36.7	36.1
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	12.3	12.3	12.3	12.3	12.3	12.3
LEADING EDGE MEMBERS	5.4	5.4	5.3	5.3	5.2	5.2
DRUMS	31.3	31.0	30.7	30.5	30.2	29.9
LATCHES	.3	.3	.3	.3	.3	.3

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE GE ROLLOUT   POWER/WING = 75.0 KW   ARRAY WIDTH = 7.00 M

BLANKET AREA = .83333+06 IN*SQ   BLANKET WEIGHT = 457.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.009	.019	.026	.033	.040	.048
***** TORSIONAL FREQUENCY HZ *****	.009	.019	.026	.033	.040	.048
***** BENDING FREQUENCY HZ *****	.017	.038	.053	.068	.086	.107
*** ARRAY PROPERTIES ***						
BLANKET WIDTH (IN)	116.6	112.5	108.9	106.4	103.6	100.5
ARRAY LENGTH (M)	90.77	94.05	97.17	99.49	102.18	105.30
ASPECT RATIO	12.97	13.44	13.88	14.21	14.60	15.04
ARRAY MASS (KG)	287.4	343.1	390.7	442.8	516.0	609.0
ARRAY WEIGHT (LB)	632.4	754.8	859.5	974.2	1135.2	1339.8
CENTER OF GRAVITY (IN)	1477.8	1434.5	1412.9	1385.3	1345.4	1315.0
TENSION PER BLANKET (LB)	2.50	12.50	25.00	42.50	70.00	112.00
MOMENT OF INERTIA I1	.2256+10	.2712+10	.3147+10	.3587+10	.4178+10	.4980+10
MOMENT OF INERTIA I2	.2924+07	.2723+07	.2552+07	.2438+07	.2322+07	.2198+07
SPECIFIC POWER (KW/KG)	.261	.219	.192	.169	.145	.123
SPECIFIC WEIGHT (KG/KW)	3.8	4.6	5.2	5.9	6.9	8.1
BLANKET - MAST CLEARANCE (IN)	12.6	12.1	12.8	12.7	12.6	12.5
*** BOOM PROPERTIES ***						
DIAMETER (IN)	17.14	26.26	32.15	37.39	43.19	49.62
EI (LB*IN*SQ)	.92432+07	.49615+08	.10592+09	.18878+09	.32795+09	.55725+09
ROOT SPRING (LB*IN/RAD)	.1222+06	.4310+06	.7611+06	.1174+07	.1777+07	.2644+07
BUCKLING CAPABILITY RATIO	78.60	36.89	27.65	21.99	17.82	14.70
STRENGTH CAPABILITY RATIO	1.80	5.59	9.15	12.95	17.64	23.19
*** CANNISTER PROPERTIES ***						
HEIGHT (IN)	55.40	65.73	71.96	77.71	84.15	91.35
DIAMETER (IN)	20.23	30.99	37.94	44.12	50.97	58.55
*** WEIGHTS (LB) ***						
ARRAY	632.4	754.8	859.5	974.2	1135.2	1339.8
BOOM	40.8	96.6	142.2	191.9	256.6	340.4
CANNISTER	42.4	99.6	149.1	201.4	268.7	354.5
TENSION MECHANISM	2.7	7.9	14.6	23.4	43.3	65.1
MAST SLEEVE	12.6	18.7	23.0	27.0	31.5	36.8
SHAFT	12.1	11.3	10.6	10.1	13.8	19.7
HEADER	2.7	3.4	4.1	5.0	6.4	8.4
DRUM BEARING	1.5	1.8	2.2	2.7	3.5	4.7
CENTER SUPPORT	20.6	19.6	18.6	18.0	17.3	16.6
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	12.7	12.7	12.7	12.7	12.7	12.7
LEADING EDGE MEMBERS	3.6	3.4	3.3	3.3	3.2	3.1
DRUMS	21.2	20.5	19.9	19.4	19.0	18.4
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 75.0 KW   ARRAY WIDTH = 7.50 M

BLANKET AREA = .83333+06 IN-SQ   BLANKET WEIGHT = 457.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.009	.020	.027	.035	.043	.052
***** TORSIONAL FREQUENCY HZ *****	.009	.020	.027	.035	.043	.052
***** BENDING FREQUENCY HZ *****	.018	.039	.055	.071	.090	.113
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	126.9	123.0	119.8	117.5	114.9	112.1
ARRAY LENGTH (M)	83.42	86.03	88.37	90.06	92.08	94.40
ASPECT RATIO	11.12	11.47	11.78	12.01	12.28	12.59
ARRAY MASS (KG)	285.5	334.0	374.7	419.0	482.5	562.1
ARRAY WEIGHT (LB)	628.1	734.7	824.3	921.8	1061.5	1236.7
CENTER OF GRAVITY (IN)	1352.3	1316.0	1297.6	1271.0	1229.7	1195.6
TENSION PER BLANKET (LB)	2.50	12.50	25.00	42.50	70.00	112.00
MOMENT OF INERTIA I1	.1886+10	.2217+10	.2523+10	.2823+10	.3224+10	.3757+10
MOMENT OF INERTIA I2	.3477+07	.3269+07	.3100+07	.2989+07	.2872+07	.2749+07
SPECIFIC POWER (KW/KG)	.263	.225	.200	.179	.155	.135
SPECIFIC WEIGHT (KG/KW)	3.8	4.5	5.0	5.6	6.4	7.5
BLANKET - MAST CLEARANCE (IN)	12.7	12.3	12.9	12.8	12.7	12.6
* BOOM PROPERTIES *						
DIAMETER (IN)	16.12	24.64	29.89	34.68	39.98	45.81
EI (LB-IN-SQ)	.78065+07	.41513+08	.87605+08	.15469+09	.26633+09	.44780+09
ROOT SPRING (LB-IN/RAD)	.1077+06	.3770+06	.6601+06	.1011+07	.1520+07	.2244+07
BUCKLING CAPABILITY RATIO	69.46	32.46	23.89	18.91	15.26	12.53
STRENGTH CAPABILITY RATIO	1.65	5.17	8.35	11.90	16.37	21.75
* CANNISTER PROPERTIES *						
HEIGHT (IN)	52.83	62.39	68.34	73.48	79.26	85.67
DIAMETER (IN)	19.02	29.07	35.27	40.92	47.17	54.06
* WEIGHTS (LB) *						
ARRAY	628.1	734.7	824.3	921.8	1061.5	1236.7
BOOM	35.8	84.0	123.8	165.5	219.2	287.6
CANNISTER	37.6	87.7	129.1	173.6	230.7	302.8
TENSION MECHANISM	2.6	7.3	13.3	21.3	39.2	58.6
MAST SLEEVE	11.1	16.3	19.8	23.0	26.7	30.9
SHAFT	14.4	13.5	12.8	12.3	18.5	27.0
HEADER	2.8	3.5	4.4	5.6	7.3	9.8
DRUM BEARING	1.5	1.8	2.2	2.7	3.5	4.7
CENTER SUPPORT	23.6	22.4	21.5	20.9	20.2	19.5
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	12.7	12.7	12.7	12.7	12.7	12.7
LEADING EDGE MEMBERS	3.9	3.8	3.7	3.6	3.5	3.4
DRUMS	22.9	22.3	21.7	21.3	20.9	20.4
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 75.0 KW ARRAY WIDTH = 8.00 M

BLANKET AREA = .83333+06 IN-SQ BLANKET WEIGHT = 457.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.021	.029	.037	.045	.055
***** TORSIONAL FREQUENCY HZ *****	.010	.021	.029	.037	.045	.055
***** BENDING FREQUENCY HZ *****	.019	.041	.058	.074	.095	.118
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	137.1	133.4	131.3	128.4	126.0	123.5
ARRAY LENGTH (M)	77.22	79.35	80.62	82.43	84.01	85.70
ASPECT RATIO	9.65	9.92	10.08	10.30	10.50	10.71
ARRAY MASS (KG)	284.8	327.5	362.2	402.0	458.6	528.9
ARRAY WEIGHT (LB)	626.5	720.6	796.9	884.5	1008.9	1163.6
CENTER OF GRAVITY (IN)	1244.5	1214.9	1189.3	1175.2	1135.0	1098.5
TENSION PER BLANKET (LB)	2.50	12.50	25.00	42.50	70.00	112.00
MOMENT OF INERTIA I1	.1603+10	.1853+10	.2043+10	.2296+10	.2586+10	.2956+10
MOMENT OF INERTIA I2	.4076+07	.3860+07	.3743+07	.3584+07	.3468+07	.3352+07
SPECIFIC POWER (KW/KG)	.263	.229	.207	.187	.164	.142
SPECIFIC WEIGHT (KG/KW)	3.8	4.4	4.8	5.4	6.1	7.1
BLANKET - MAST CLEARANCE (IN)	12.8	12.5	12.2	12.9	12.9	12.7
* BOOM PROPERTIES *						
DIAMETER (IN)	15.20	23.20	27.99	32.32	37.21	42.54
EI (LB-IN-SQ)	.66889+07	.35314+08	.72906+08	.12959+09	.22166+09	.36906+09
ROOT SPRING (LB-IN/RAD)	.9588+05	.3340+06	.5752+06	.8854+06	.1324+07	.1941+07
BUCKLING CAPABILITY RATIO	61.78	28.78	20.95	16.43	13.22	10.80
STRENGTH CAPABILITY RATIO	1.51	4.77	7.74	10.86	15.04	20.14
* CANNISTER PROPERTIES *						
HEIGHT (IN)	50.71	59.66	64.75	70.14	75.40	81.14
DIAMETER (IN)	17.94	27.37	33.03	38.14	43.90	50.20
* WEIGHTS (LB) *						
ARRAY	626.5	720.6	796.9	884.5	1008.9	1163.6
BOOM	31.9	74.4	107.2	146.1	192.2	249.6
CANNISTER	33.5	77.9	113.4	151.2	200.2	261.6
TENSION MECHANISM	2.4	6.8	12.3	19.6	35.9	53.4
MAST SLEEVE	9.9	14.4	17.2	19.9	22.9	26.4
SHAFT	16.9	16.0	15.5	15.8	24.0	35.7
HEADER	2.8	3.7	4.8	6.2	8.3	11.4
DRUM BEARING	1.5	1.8	2.2	2.7	3.5	4.7
CENTER SUPPORT	26.7	25.5	24.9	24.0	23.3	22.6
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.5
SLIP RING ASSEMBLY	12.7	12.7	12.7	12.7	12.7	12.7
LEADING EDGE MEMBERS	4.2	4.1	4.0	3.9	3.9	3.8
DRUMS	24.6	24.0	23.7	23.2	22.8	22.3
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 75.0 KW   ARRAY WIDTH = 8.50 M

BLANKET AREA = .83333+06 IN=SQ   BLANKET WEIGHT = 457.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.010	.022	.030	.038	.048	.058
***** TORSIONAL FREQUENCY HZ *****	.010	.022	.030	.038	.048	.058
***** BENDING FREQUENCY HZ *****	.019	.043	.060	.078	.099	.124
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	147.2	143.7	141.7	139.9	136.9	134.6
ARRAY LENGTH (M)	71.89	73.65	74.69	75.65	77.31	78.64
ASPECT RATIO	8.46	8.66	8.79	8.90	9.10	9.25
ARRAY MASS (KG)	284.9	323.1	354.0	389.0	441.3	505.5
ARRAY WEIGHT (LB)	626.8	710.8	778.9	855.8	970.9	1112.1
CENTER OF GRAVITY (IN)	1150.2	1126.5	1105.1	1083.0	1050.1	1013.3
TENSION PER BLANKET (LB)	2.50	12.50	25.00	42.50	70.00	112.00
MOMENT OF INERTIA I1	.1381+10	.1575+10	.1721+10	.1862+10	.2123+10	.2399+10
MOMENT OF INERTIA I2	.4723+07	.4500+07	.4379+07	.4278+07	.4115+07	.4002+07
SPECIFIC POWER (KW/KG)	.263	.232	.212	.193	.170	.148
SPECIFIC WEIGHT (KG/KW)	3.8	4.3	4.7	5.2	5.9	6.7
BLANKET - MAST CLEARANCE (IN)	12.9	12.7	12.4	12.3	12.9	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	14.37	21.90	26.41	30.35	34.99	39.95
EI (LB-IN-SQ)	.57973+07	.30424+08	.62587+08	.10914+09	.18772+09	.31079+09
ROOT SPRING (LB-IN/RAD)	.8613+05	.2986+06	.5130+06	.7784+06	.1169+07	.1706+07
BUCKLING CAPABILITY RATIO	55.23	25.65	18.65	14.48	11.69	9.53
STRENGTH CAPABILITY RATIO	1.38	4.39	7.15	10.08	14.04	18.92
* CANNISTER PROPERTIES *						
HEIGHT (IN)	48.96	57.36	62.13	66.79	71.92	77.21
DIAMETER (IN)	16.96	25.84	31.16	35.81	41.28	47.14
* WEIGHTS (LB) *						
ARRAY	626.8	710.8	778.9	855.8	970.9	1112.1
BOOM	28.8	66.7	95.8	128.1	169.3	218.7
CANNISTER	30.0	69.6	101.1	133.5	177.4	231.2
TENSION MECHANISM	2.3	6.4	11.5	18.1	33.2	49.3
MAST SLEEVE	8.9	12.8	15.2	17.4	20.1	23.0
SHAFT	19.5	18.6	18.1	20.1	30.5	45.9
HEADER	2.8	3.9	5.2	6.9	9.3	13.1
DRUM BEARING	1.5	1.8	2.2	2.7	3.5	4.7
CENTER SUPPORT	30.1	28.9	28.2	27.6	26.6	25.9
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	12.7	12.7	12.7	12.7	12.7	12.7
LEADING EDGE MEMBERS	4.5	4.4	4.3	4.3	4.2	4.1
DRUMS	26.4	25.8	25.4	25.1	24.6	24.2
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 75.0 KW ARRAY WIDTH = 9.00 M

BLANKET AREA = .83333+06 IN=SQ BLANKET WEIGHT = 457.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.023	.031	.040	.050	.061
***** TORSIONAL FREQUENCY HZ *****	.011	.023	.031	.040	.050	.061
***** BENDING FREQUENCY HZ *****	.020	.044	.062	.080	.103	.128
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	157.4	154.0	152.1	150.3	148.5	145.4
ARRAY LENGTH (M)	67.26	68.73	69.60	70.40	71.27	72.79
ASPECT RATIO	7.47	7.64	7.73	7.82	7.92	8.09
ARRAY MASS (KG)	285.9	320.3	348.1	380.6	428.3	489.3
ARRAY WEIGHT (LB)	628.9	704.6	765.8	837.3	942.2	1076.4
CENTER OF GRAVITY (IN)	1066.3	1046.9	1031.0	1007.3	970.1	940.1
TENSION PER BLANKET (LB)	2.50	12.50	25.00	42.50	70.00	112.00
MOMENT OF INERTIA I1	.1203+10	.1355+10	.1473+10	.1597+10	.1759+10	.2000+10
MOMENT OF INERTIA I2	.5419+07	.5190+07	.5066+07	.4963+07	.4868+07	.4698+07
SPECIFIC POWER (KW/KG)	.262	.234	.215	.197	.175	.153
SPECIFIC WEIGHT (KG/KW)	3.8	4.3	4.6	5.1	5.7	6.5
BLANKET - MAST CLEARANCE (IN)	13.0	12.7	12.6	12.4	12.2	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	13.71	20.87	24.97	28.88	32.92	37.67
EI (LB=IN=SQ)	.50744+07	.26496+08	.54344+08	.94508+08	.15953+09	.26624+09
ROOT SPRING (LB=IN/RAD)	.7794+05	.2692+06	.4614+06	.6988+06	.1035+07	.1519+07
BUCKLING CAPABILITY RATIO	50.26	23.29	16.68	13.12	10.35	8.47
STRENGTH CAPABILITY RATIO	1.29	4.12	6.60	9.55	13.05	17.66
* CANNISTER PROPERTIES *						
HEIGHT (IN)	47.08	55.05	59.92	63.96	68.73	73.96
DIAMETER (IN)	16.18	24.63	29.47	34.08	38.84	44.45
* WEIGHTS (LB) *						
ARRAY	628.9	704.6	765.8	837.3	942.2	1076.4
BOOM	25.9	59.7	86.6	114.0	149.9	195.1
CANNISTER	27.3	63.3	90.6	121.1	157.3	205.9
TENSION MECHANISM	2.2	6.0	10.8	17.0	30.9	45.9
MAST SLEEVE	8.1	11.5	13.6	15.6	17.7	20.4
SHAFT	22.4	21.4	20.8	24.7	38.7	57.7
HEADER	2.9	4.1	5.5	7.5	10.5	14.8
DRUM BEARING	1.5	1.8	2.2	2.7	3.5	4.7
CENTER SUPPORT	33.7	32.5	31.8	31.2	30.5	29.5
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	12.7	12.7	12.7	12.7	12.7	12.7
LEADING EDGE MEMBERS	4.8	4.7	4.7	4.6	4.5	4.4
DRUMS	28.1	27.5	27.2	26.9	26.6	26.1
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 75.0 KW ARRAY WIDTH = 9.50 M

BLANKET AREA = .83333+06 IN=SQ BLANKET WEIGHT = 457.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.024	.033	.042	.052	.063
***** TORSIONAL FREQUENCY HZ *****	.011	.024	.033	.042	.052	.063
***** BENDING FREQUENCY HZ *****	.021	.046	.064	.083	.106	.134
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	168.3	164.2	162.4	160.7	159.0	157.1
ARRAY LENGTH (M)	62.88	64.44	65.17	65.84	66.57	67.37
ASPECT RATIO	6.62	6.78	6.86	6.93	7.01	7.09
ARRAY MASS (KG)	287.6	318.7	344.0	374.7	420.3	477.6
ARRAY WEIGHT (LB)	632.8	701.1	756.8	824.4	924.6	1050.7
CENTER OF GRAVITY (IN)	985.8	976.1	963.0	942.2	903.6	866.6
TENSION PER BLANKET (LB)	2.50	12.50	25.00	42.50	70.00	112.00
MOMENT OF INERTIA I1	.1047+10	.1180+10	.1275+10	.1378+10	.1506+10	.1676+10
MOMENT OF INERTIA I2	.6229+07	.5930+07	.5804+07	.5701+07	.5608+07	.5519+07
SPECIFIC POWER (KW/KG)	.261	.235	.218	.200	.178	.157
SPECIFIC WEIGHT (KG/KW)	3.8	4.2	4.6	5.0	5.6	6.4
BLANKET - MAST CLEARANCE (IN)	12.2	12.8	12.7	12.6	12.3	12.2
* BOOM PROPERTIES *						
DIAMETER (IN)	13.07	19.93	23.83	27.35	31.38	35.50
EI (LB-IN-SQ)	.44355+07	.23291+08	.47650+08	.82675+08	.13921+09	.22808+09
ROOT SPRING (LB-IN/RAD)	.7046+05	.2444+06	.4181+06	.6321+06	.9343+06	.1353+07
BUCKLING CAPABILITY RATIO	45.70	21.24	15.19	11.77	9.40	7.52
STRENGTH CAPABILITY RATIO	1.20	3.87	6.21	8.81	12.36	16.39
* CANNISTER PROPERTIES *						
HEIGHT (IN)	45.27	53.05	57.68	61.86	66.03	70.91
DIAMETER (IN)	15.43	23.52	28.12	32.28	37.03	41.89
* WEIGHTS (LB) *						
ARRAY	632.8	701.1	756.8	824.4	924.6	1050.7
BOOM	23.3	54.0	78.1	103.9	134.5	174.2
CANNISTER	24.9	57.8	82.7	108.9	143.2	183.2
TENSION MECHANISM	2.1	5.7	10.2	16.1	29.0	42.8
MAST SLEEVE	7.3	10.5	12.3	14.0	15.9	18.0
SHAFT	25.7	24.4	23.8	30.0	47.3	72.5
HEADER	2.9	4.3	6.0	8.2	11.7	16.9
DRUM BEARING	1.5	1.8	2.2	2.7	3.5	4.7
CENTER SUPPORT	38.0	36.3	35.6	35.0	34.3	33.6
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	12.7	12.7	12.7	12.7	12.7	12.7
LEADING EDGE MEMBERS	5.1	5.0	5.0	4.9	4.9	4.8
DRUMS	29.9	29.2	28.9	28.6	28.4	28.0
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 75.0 KW   ARRAY WIDTH = 10.00 M

BLANKET AREA = .83333+06 IN*SQ   BLANKET WEIGHT = 457.6 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.011	.024	.034	.043	.054	.066
***** TORSIONAL FREQUENCY HZ *****	.011	.024	.034	.043	.054	.066
***** BENDING FREQUENCY HZ *****	.021	.047	.066	.086	.110	.138
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	177.2	174.5	172.7	171.1	169.4	167.6
ARRAY LENGTH (M)	59.74	60.66	61.29	61.86	62.47	63.15
ASPECT RATIO	5.97	6.07	6.13	6.19	6.25	6.31
ARRAY MASS (KG)	289.5	318.2	341.3	371.0	415.3	471.5
ARRAY WEIGHT (LB)	636.9	699.9	750.9	816.3	913.7	1037.3
CENTER OF GRAVITY (IN)	927.5	912.7	902.1	881.1	843.6	808.4
TENSION PER BLANKET (LB)	2.50	12.50	25.00	42.50	70.00	112.00
MOMENT OF INERTIA I1	.9425+09	.1038+10	.1116+10	.1201+10	.1307+10	.1449+10
MOMENT OF INERTIA I2	.6928+07	.6721+07	.6593+07	.6491+07	.6402+07	.6320+07
SPECIFIC POWER (KW/KG)	.259	.236	.220	.202	.181	.159
SPECIFIC WEIGHT (KG/KW)	3.9	4.2	4.6	4.9	5.5	6.3
BLANKET - MAST CLEARANCE (IN)	13.4	12.9	12.8	12.7	12.5	12.3
* BOOM PROPERTIES *						
DIAMETER (IN)	12.56	19.07	22.79	26.14	29.97	33.89
EI (LB-IN-SQ)	.40031+07	.20641+08	.42137+08	.72966+08	.12260+09	.20039+09
ROOT SPRING (LB-IN/RAD)	.6524+05	.2232+06	.3813+06	.5755+06	.8493+06	.1228+07
BUCKLING CAPABILITY RATIO	42.20	19.44	13.89	10.75	8.58	6.86
STRENGTH CAPABILITY RATIO	1.12	3.63	5.84	8.31	11.68	15.52
* CANNISTER PROPERTIES *						
HEIGHT (IN)	44.14	51.30	55.72	59.71	63.67	68.31
DIAMETER (IN)	14.82	22.50	26.89	30.85	35.37	39.99
* WEIGHTS (LB) *						
ARRAY	636.9	699.9	750.9	816.3	913.7	1037.3
BOOM	21.6	49.2	71.0	94.3	121.8	157.4
CANNISTER	23.0	53.0	75.7	99.6	130.8	167.3
TENSION MECHANISM	2.1	5.5	9.7	15.2	27.5	40.4
MAST SLEEVE	6.8	9.6	11.2	12.7	14.5	16.3
SHAFT	28.5	27.6	27.0	36.0	57.0	87.8
HEADER	3.0	4.5	6.4	9.0	12.9	18.8
DRUM BEARING	1.5	1.8	2.2	2.7	3.5	4.7
CENTER SUPPORT	41.6	40.5	39.7	39.1	38.4	37.7
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	12.7	12.7	12.7	12.7	12.7	12.7
LEADING EDGE MEMBERS	5.4	5.3	5.3	5.2	5.2	5.1
DRUMS	31.4	31.0	30.7	30.4	30.1	29.8
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GF ROLLOUT POWER/WING = 80.0 KW ARRAY WIDTH = 7.00 M

BLANKET AREA = .88889+06 IN=SQ BLANKET WEIGHT = 488.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.014	.026	.032	.040	.047	.051
***** TORSIONAL FREQUENCY HZ *****	.014	.026	.032	.040	.047	.051
***** BENDING FREQUENCY HZ *****	.028	.054	.068	.087	.107	.120
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	113.5	107.2	104.5	101.1	98.0	95.8
ARRAY LENGTH (M)	99.46	105.32	108.07	111.61	115.16	117.87
ASPECT RATIO	14.21	15.05	15.44	15.94	16.45	16.84
ARRAY MASS (KG)	342.8	440.4	502.8	598.2	705.2	792.7
ARRAY WEIGHT (LB)	754.1	968.8	1106.2	1315.9	1551.5	1744.0
CENTER OF GRAVITY (IN)	1554.6	1505.4	1478.8	1443.2	1416.3	1400.6
TENSION PER BLANKET (LB)	7.50	30.00	50.00	85.00	130.00	170.00
MOMENT OF INERTIA I1	.3101+10	.4094+10	.4721+10	.5673+10	.6788+10	.7737+10
MOMENT OF INERTIA I2	.2944+07	.2629+07	.2501+07	.2355+07	.2226+07	.2137+07
SPECIFIC POWER (KW/KG)	.233	.182	.159	.134	.113	.101
SPECIFIC WEIGHT (KG/KW)	4.3	5.5	6.3	7.5	8.8	9.9
BLANKET - MAST CLEARANCE (IN)	12.2	12.8	12.7	12.5	12.3	12.2
* BOOM PROPERTIES *						
DIAMETER (IN)	24.23	35.70	41.35	48.27	54.87	59.72
EI (LB-IN-SQ)	.33293+08	.14931+09	.26202+09	.47512+09	.77353+09	.10599+10
ROOT SPRING (LB-IN/RAD)	.3195+06	.9847+06	.1501+07	.2346+07	.3381+07	.4282+07
BUCKLING CAPABILITY RATIO	52.32	28.40	22.86	18.33	15.48	14.03
STRENGTH CAPABILITY RATIO	4.06	10.43	14.45	19.81	25.13	29.16
* CANNISTER PROPERTIES *						
HEIGHT (IN)	64.06	77.02	83.26	91.06	98.47	103.75
DIAMETER (IN)	28.59	42.13	48.79	56.96	64.74	70.47
* WEIGHTS (LB) *						
ARRAY	754.1	968.8	1106.2	1315.9	1551.5	1744.0
BOOM	80.6	176.2	236.6	325.0	422.7	500.3
CANNISTER	84.6	183.5	246.0	335.2	432.8	512.6
TENSION MECHANISM	5.7	19.3	29.4	49.2	75.9	100.0
MAST SLEEVE	18.4	27.3	31.9	37.9	44.0	48.6
SHAFT	12.2	10.9	10.3	15.4	21.1	25.6
HEADER	3.1	4.3	5.4	7.1	9.0	10.6
DRUM BEARING	1.7	2.3	2.9	4.0	5.3	6.4
CENTER SUPPORT	20.8	19.1	18.3	17.5	16.7	16.2
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	13.1	13.1	13.1	13.1	13.1	13.1
LEADING EDGE MEMBERS	3.5	3.3	3.2	3.1	3.0	2.9
DRUMS	20.7	19.7	19.2	18.6	18.1	17.7
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 80.0 KW ARRAY WIDTH = 7.50 M

BLANKET AREA = .88889+06 IN-SQ BLANKET WEIGHT = 488.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.015	.028	.035	.043	.051	.056
***** TORSIONAL FREQUENCY HZ *****	.015	.028	.035	.043	.051	.056
***** BENDING FREQUENCY HZ *****	.029	.056	.072	.092	.113	.128
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	123.9	118.1	115.7	112.7	109.8	107.9
ARRAY LENGTH (M)	91.14	95.55	97.54	100.18	102.79	104.60
ASPECT RATIO	12.15	12.74	13.01	13.36	13.71	13.95
ARRAY MASS (KG)	335.8	419.3	472.5	554.0	644.6	717.0
ARRAY WEIGHT (LB)	738.7	922.6	1039.6	1216.7	1418.0	1577.3
CENTER OF GRAVITY (IN)	1427.8	1381.5	1353.2	1314.2	1281.7	1258.6
TENSION PER BLANKET (LB)	7.50	30.00	50.00	85.00	130.00	170.00
MOMENT OF INERTIA I1	.2558+10	.3250+10	.3670+10	.4304+10	.5026+10	.5599+10
MOMENT OF INERTIA I2	.3521+07	.3208+07	.3084+07	.2936+07	.2807+07	.2726+07
SPECIFIC POWER (KW/KG)	.238	.191	.169	.144	.124	.112
SPECIFIC WEIGHT (KG/KW)	4.2	5.2	5.9	6.9	8.1	9.0
BLANKET - MAST CLEARANCE (IN)	12.5	12.9	12.7	12.6	12.5	12.3
* BOOM PROPERTIES *						
DIAMETER (IN)	22.61	33.16	38.31	44.61	50.57	54.89
EI (LB-IN-SQ)	.27954+08	.12290+09	.21346+09	.38280+09	.61630+09	.83459+09
ROOT SPRING (LB-IN/RAD)	.2803+06	.8509+06	.1287+07	.1995+07	.2851+07	.3580+07
BUCKLING CAPABILITY RATIO	45.56	24.50	19.62	15.65	13.15	11.85
STRENGTH CAPABILITY RATIO	3.66	9.57	13.37	18.54	23.79	27.86
* CANNISTER PROPERTIES *						
HEIGHT (IN)	61.28	72.95	78.50	85.46	92.00	96.51
DIAMETER (IN)	26.68	39.13	45.21	52.64	59.67	64.78
* WEIGHTS (LB) *						
ARRAY	738.7	922.6	1039.6	1218.7	1418.0	1577.3
BOOM	71.2	152.5	202.6	275.2	353.8	413.8
CANNISTER	73.8	158.6	211.6	286.9	368.4	433.9
TENSION MECHANISM	5.3	17.6	26.6	44.3	67.8	88.8
MAST SLEEVE	16.0	23.3	27.1	31.9	36.6	40.2
SHAFT	14.6	13.3	13.7	21.0	29.3	36.2
HEADER	3.1	4.7	6.0	8.1	10.7	12.8
DRUM BEARING	1.7	2.3	2.9	4.0	5.3	6.4
CENTER SUPPORT	23.8	22.1	21.4	20.5	19.8	19.2
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	13.1	13.1	13.1	13.1	13.1	13.1
LEADING EDGE MEMBERS	3.8	3.6	3.5	3.4	3.4	3.3
DRUMS	22.5	21.5	21.1	20.6	20.1	19.8
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 80.0 KW ARRAY WIDTH = 8.00 M

BLANKET AREA = .88889+06 IN-SQ BLANKET WEIGHT = 488.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.016	.029	.037	.046	.054	.060
***** TORSIONAL FREQUENCY HZ *****	.016	.029	.037	.046	.054	.060
***** BENDING FREQUENCY HZ *****	.030	.059	.075	.097	.119	.134
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	134.3	130.0	126.7	123.9	121.4	119.5
ARRAY LENGTH (M)	84.09	86.83	89.08	91.12	93.00	94.48
ASPECT RATIO	10.51	10.85	11.13	11.39	11.62	11.81
ARRAY MASS (KG)	331.0	402.6	450.7	522.5	601.6	665.4
ARRAY WEIGHT (LB)	728.2	885.7	991.4	1149.5	1323.5	1464.0
CENTER OF GRAVITY (IN)	1315.6	1266.4	1249.7	1210.1	1173.9	1150.5
TENSION PER BLANKET (LB)	7.50	30.00	50.00	85.00	130.00	170.00
MOMENT OF INERTIA I1	.2146+10	.2603+10	.2956+10	.3407+10	.3898+10	.4306+10
MOMENT OF INERTIA I2	.4154+07	.3903+07	.3714+07	.3566+07	.3446+07	.3358+07
SPECIFIC POWER (KW/KG)	.242	.199	.178	.153	.133	.120
SPECIFIC WEIGHT (KG/KW)	4.1	5.0	5.6	6.5	7.5	8.3
BLANKET - MAST CLEARANCE (IN)	12.6	12.1	12.9	12.8	12.6	12.6
* BOOM PROPERTIES *						
DIAMETER (IN)	21.30	30.81	35.68	41.48	46.90	50.88
EI (LB-IN-SQ)	.23795+08	.10148+09	.17802+09	.31666+09	.50447+09	.68093+09
ROOT SPRING (LB-IN/RAD)	.2484+06	.7371+06	.1124+07	.1731+07	.2454+07	.3073+07
BUCKLING CAPABILITY RATIO	40.42	21.15	17.02	13.53	11.31	10.18
STRENGTH CAPABILITY RATIO	3.37	8.71	12.26	17.15	22.20	26.14
* CANNISTER PROPERTIES *						
HEIGHT (IN)	58.59	69.24	74.73	81.05	86.86	90.97
DIAMETER (IN)	25.13	36.35	42.11	48.94	55.34	60.03
* WEIGHTS (LB) *						
ARRAY	728.2	885.7	991.4	1149.5	1323.5	1464.0
BOOM	63.0	132.6	177.9	239.6	304.7	355.0
CANNISTER	65.6	137.2	184.0	248.4	317.5	373.4
TENSION MECHANISM	5.0	16.1	24.4	40.4	61.5	80.4
MAST SLEEVE	14.1	20.0	23.3	27.3	31.1	34.1
SHAFT	17.2	16.1	17.7	27.6	39.3	48.7
HEADER	3.3	5.2	6.7	9.5	12.5	15.1
DRUM BEARING	1.7	2.3	2.9	4.0	5.3	6.4
CENTER SUPPORT	27.1	25.7	24.7	23.8	23.0	22.5
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	13.1	13.1	13.1	13.1	13.1	13.1
LEADING EDGE MEMBERS	4.1	4.0	3.9	3.8	3.7	3.7
DRUMS	24.3	23.5	23.0	22.5	22.1	21.8
LATCHES	.3	.3	.3	.3	.3	.3

ORIGINAL PAGE IS
OF POOR QUALITY

ARRAY TYPE GE ROLLOUT   POWER/WING = 80.0 KW   ARRAY WIDTH = 8.50 M

BLANKET AREA = .88889+06 IN-SQ   BLANKET WEIGHT = 488.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.016	.031	.039	.048	.057	.064
***** TORSIONAL FREQUENCY HZ *****	.016	.031	.039	.048	.057	.064
***** BENDING FREQUENCY HZ *****	.031	.061	.079	.101	.124	.141
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	144.5	140.5	138.6	134.9	132.6	130.8
ARRAY LENGTH (M)	78.11	80.36	81.45	83.66	85.13	86.29
ASPECT RATIO	9.19	9.45	9.58	9.84	10.02	10.15
ARRAY MASS (KG)	328.0	391.7	433.4	499.8	571.4	629.0
ARRAY WEIGHT (LB)	721.5	861.7	953.6	1099.5	1257.1	1383.8
CENTER OF GRAVITY (IN)	1218.4	1177.2	1148.6	1117.7	1080.6	1060.9
TENSION PER BLANKET (LB)	7.50	30.00	50.00	85.00	130.00	170.00
MOMENT OF INERTIA I1	.1830+10	.2181+10	.2394+10	.2770+10	.3130+10	.3440+10
MOMENT OF INERTIA I2	.4835+07	.4575+07	.4464+07	.4251+07	.4133+07	.4048+07
SPECIFIC POWER (KW/KG)	.244	.204	.185	.160	.140	.127
SPECIFIC WEIGHT (KG/KW)	4.1	4.9	5.4	6.2	7.1	7.9
BLANKET - MAST CLEARANCE (IN)	12.7	12.3	12.0	12.9	12.7	12.8
* BOOM PROPERTIES *						
DIAMETER (IN)	20.12	29.05	33.46	38.97	44.01	47.38
EI (LB-IN-SQ)	.20530+08	.86930+08	.14885+09	.26695+09	.42276+09	.56800+09
ROOT SPRING (LB-IN/RAD)	.2223+06	.6563+06	.9824+06	.1522+07	.2149+07	.2682+07
BUCKLING CAPABILITY RATIO	36.08	18.81	14.97	11.95	9.96	8.83
STRENGTH CAPABILITY RATIO	3.10	8.08	11.43	16.11	20.98	24.23
* CANNISTER PROPERTIES *						
HEIGHT (IN)	56.37	66.35	70.92	77.13	82.46	86.50
DIAMETER (IN)	23.74	34.28	39.48	45.99	51.93	55.91
* WEIGHTS (LB) *						
ARRAY	721.5	861.7	953.6	1099.5	1257.1	1383.8
BOOM	56.6	118.2	154.7	210.0	265.4	311.8
CANNISTER	58.7	122.3	162.0	219.7	280.0	324.6
TENSION MECHANISM	4.7	15.0	22.5	37.3	56.6	73.7
MAST SLEEVE	12.6	17.7	20.3	23.8	27.1	29.3
SHAFT	20.0	18.9	22.9	35.4	50.9	63.7
HEADER	3.4	5.6	7.5	10.6	14.4	17.6
DRUM BEARING	1.7	2.3	2.9	4.0	5.3	6.4
CENTER SUPPORT	30.7	29.3	28.6	27.4	26.6	26.0
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	13.1	13.1	13.1	13.1	13.1	13.1
LEADING EDGE MEMBERS	4.4	4.3	4.2	4.1	4.1	4.0
DRUMS	26.0	25.3	25.0	24.4	24.0	23.7
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT   POWER/WING = 80.0 KW   ARRAY WIDTH = 9.00 M

BLANKET AREA = .88889+06 IN-SQ   BLANKET WEIGHT = 488.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.017	.032	.040	.050	.060	.067
***** TORSIONAL FREQUENCY HZ *****	.017	.032	.040	.050	.060	.067
***** BENDING FREQUENCY HZ *****	.032	.063	.081	.105	.129	.147
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	154.8	150.9	149.1	145.9	143.7	142.0
ARRAY LENGTH (M)	72.94	74.81	75.72	77.40	78.57	79.50
ASPECT RATIO	8.10	8.31	8.41	8.60	8.73	8.83
ARRAY MASS (KG)	326.3	383.6	422.4	483.4	550.0	603.5
ARRAY WEIGHT (LB)	717.9	844.0	929.3	1063.5	1210.1	1327.8
CENTER OF GRAVITY (IN)	1131.1	1096.2	1071.1	1037.5	1000.2	979.3
TENSION PER BLANKET (LB)	7.50	30.00	50.00	85.00	130.00	170.00
MOMENT OF INERTIA I1	.1580+10	.1855+10	.2026+10	.2307+10	.2583+10	.2818+10
MOMENT OF INERTIA I2	.5568+07	.5301+07	.5188+07	.4992+07	.4879+07	.4797+07
SPECIFIC POWER (KW/KG)	.245	.209	.189	.165	.145	.133
SPECIFIC WEIGHT (KG/KW)	4.1	4.8	5.3	6.0	6.9	7.5
BLANKET - MAST CLEARANCE (IN)	12.8	12.4	12.3	12.9	12.8	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	19.18	27.66	31.62	36.75	41.45	44.59
EI (LB-IN-SQ)	.17902+08	.75345+08	.12864+09	.22846+09	.36013+09	.48208+09
ROOT SPRING (LB-IN/RAD)	.2006+06	.5895+06	.8806+06	.1355+07	.1906+07	.2372+07
BUCKLING CAPABILITY RATIO	32.79	17.05	13.37	10.62	8.84	7.82
STRENGTH CAPABILITY RATIO	2.91	7.65	10.62	15.04	19.68	22.79
* CANNISTER PROPERTIES *						
HEIGHT (IN)	54.11	63.53	68.19	73.84	78.78	82.52
DIAMETER (IN)	22.63	32.64	37.31	43.36	48.91	52.61
* WEIGHTS (LB) *						
ARRAY	717.9	844.0	929.3	1063.5	1210.1	1327.8
BOOM	50.7	105.2	139.2	187.0	235.2	275.4
CANNISTER	53.4	110.9	145.0	195.7	248.8	287.9
TENSION MECHANISM	4.4	14.1	21.0	34.7	52.5	68.3
MAST SLEEVE	11.3	15.9	18.0	21.1	23.8	25.7
SHAFT	23.0	21.8	28.3	44.4	64.5	81.2
HEADER	3.5	6.1	8.3	11.9	16.4	20.3
DRUM BEARING	1.7	2.3	2.9	4.0	5.3	6.4
CENTER SUPPORT	34.5	33.0	32.4	31.2	30.4	29.8
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	13.1	13.1	13.1	13.1	13.1	13.1
LEADING EDGE MEMBERS	4.7	4.6	4.6	4.5	4.4	4.3
DRUMS	27.7	27.1	26.8	26.2	25.9	25.6
LATCHES	.3	.3	.3	.3	.3	.3

ORIGINAL PAGE IS OF POOR QUALITY

ARRAY TYPE GE ROLLOUT POWER/WING = 80.0 KW ARRAY WIDTH = 9.50 M

BLANKET AREA = .88889+06 IN-SQ BLANKET WEIGHT = 488.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.017	.033	.042	.053	.063	.070
***** TORSIONAL FREQUENCY HZ *****	.017	.033	.042	.053	.063	.070
***** BENDING FREQUENCY HZ *****	.033	.066	.084	.109	.134	.152
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	165.0	161.3	159.5	157.5	154.5	153.1
ARRAY LENGTH (M)	68.42	70.00	70.76	71.69	73.07	73.76
ASPECT RATIO	7.20	7.37	7.45	7.55	7.69	7.76
ARRAY MASS (KG)	325.8	377.8	414.6	471.4	535.6	586.5
ARRAY WEIGHT (LB)	716.7	831.1	912.2	1037.0	1178.3	1290.2
CENTER OF GRAVITY (IN)	1053.6	1026.7	999.1	960.8	930.1	907.5
TENSION PER BLANKET (LB)	7.50	30.00	50.00	85.00	130.00	170.00
MOMENT OF INERTIA I1	.1379+10	.1602+10	.1737+10	.1935+10	.2182+10	.2365+10
MOMENT OF INERTIA I2	.6353+07	.6081+07	.5969+07	.5851+07	.5674+07	.5608+07
SPECIFIC POWER (KW/KG)	.246	.212	.193	.170	.149	.136
SPECIFIC WEIGHT (KG/KW)	4.1	4.7	5.2	5.9	6.7	7.3
BLANKET - MAST CLEARANCE (IN)	12.8	12.6	12.4	12.2	12.9	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	18.33	26.21	30.15	34.65	39.17	42.09
EI (LB-IN-SQ)	.15753+08	.65963+08	.11234+09	.19600+09	.31146+09	.41499+09
ROOT SPRING (LB-IN/RAD)	.1823+06	.5336+06	.7955+06	.1208+07	.1709+07	.2120+07
BUCKLING CAPABILITY RATIO	29.93	15.31	12.16	9.44	7.89	6.97
STRENGTH CAPABILITY RATIO	2.72	7.06	10.06	13.97	18.34	21.29
* CANNISTER PROPERTIES *						
HEIGHT (IN)	52.14	61.46	65.51	70.81	75.72	79.17
DIAMETER (IN)	21.62	30.93	35.58	40.89	46.23	49.66
* WEIGHTS (LB) *						
ARRAY	716.7	831.1	912.2	1037.0	1178.3	1290.2
BOOM	45.8	96.0	124.9	167.1	211.8	246.8
CANNISTER	48.8	99.8	132.0	174.4	222.7	257.0
TENSION MECHANISM	4.2	13.3	19.8	32.4	49.1	63.7
MAST SLEEVE	10.3	14.2	16.3	18.6	21.2	22.8
SHAFT	26.2	25.0	34.4	55.7	79.9	101.4
HEADER	3.6	6.6	9.1	13.5	18.6	23.2
DRUM BEARING	1.7	2.3	2.9	4.0	5.3	6.4
CENTER SUPPORT	38.6	37.1	36.4	35.6	34.4	33.9
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	13.1	13.1	13.1	13.1	13.1	13.1
LEADING EDGE MEMBERS	5.0	4.9	4.9	4.8	4.7	4.7
DRUMS	29.5	28.8	28.5	28.2	27.7	27.4
LATCHES	.3	.3	.3	.3	.3	.3

ARRAY TYPE GE ROLLOUT POWER/WING = 80.0 KW ARRAY WIDTH = 10.00 M

BLANKET AREA = .88889+06 IN-SQ BLANKET WEIGHT = 488.1 LB

FREQUENCY DEPENDENT PARAMETERS

***** MINIMUM FREQUENCY HZ *****	.018	.034	.043	.055	.065	.073
***** TORSIONAL FREQUENCY HZ *****	.018	.034	.043	.055	.065	.073
***** BENDING FREQUENCY HZ *****	.034	.068	.087	.113	.139	.157
* ARRAY PROPERTIES *						
BLANKET WIDTH (IN)	175.2	171.6	169.9	168.0	166.2	163.9
ARRAY LENGTH (M)	64.44	65.78	66.43	67.21	67.93	68.90
ASPECT RATIO	6.44	6.58	6.64	6.72	6.79	6.89
ARRAY MASS (KG)	326.2	373.7	409.5	464.5	525.9	576.3
ARRAY WEIGHT (LB)	717.5	822.1	900.8	1021.8	1157.1	1267.8
CENTER OF GRAVITY (IN)	984.1	962.3	934.2	896.2	860.7	840.6
TENSION PER BLANKET (LB)	7.50	30.00	50.00	85.00	130.00	170.00
MOMENT OF INERTIA I1	.1216+10	.1398+10	.1509+10	.1672+10	.1851+10	.2020+10
MOMENT OF INERTIA I2	.7192+07	.6916+07	.6805+07	.6692+07	.6608+07	.6470+07
SPECIFIC POWER (KW/KG)	.245	.214	.195	.172	.152	.139
SPECIFIC WEIGHT (KG/KW)	4.1	4.7	5.1	5.8	6.6	7.2
BLANKET - MAST CLEARANCE (IN)	12.9	12.7	12.5	12.3	12.2	12.9
* BOOM PROPERTIES *						
DIAMETER (IN)	17.54	25.06	28.81	33.10	37.00	40.12
EI (LB-IN-SQ)	.13974+08	.58255+08	.99008+08	.17229+09	.26918+09	.36207+09
ROOT SPRING (LB-IN/RAD)	.1666+06	.4861+06	.7236+06	.1096+07	.1532+07	.1913+07
BUCKLING CAPABILITY RATIO	27.42	14.00	11.10	8.61	7.04	6.33
STRENGTH CAPABILITY RATIO	2.55	6.65	9.51	13.24	17.01	20.27
* CANNISTER PROPERTIES *						
HEIGHT (IN)	50.43	59.32	63.17	68.21	72.81	76.05
DIAMETER (IN)	20.70	29.57	34.00	39.05	43.66	47.35
* WEIGHTS (LB) *						
ARRAY	717.5	822.1	900.8	1021.8	1157.1	1267.8
BOOM	41.8	87.2	113.1	151.0	190.8	221.3
CANNISTER	44.8	91.4	120.7	159.3	199.1	233.9
TENSION MECHANISM	4.0	12.6	18.7	30.5	46.0	59.9
MAST SLEEVE	9.4	13.0	14.8	16.9	18.8	20.5
SHAFT	29.6	28.4	41.4	67.3	99.3	124.2
HEADER	3.7	7.1	10.0	15.0	21.1	26.2
DRUM BEARING	1.7	2.3	2.9	4.0	5.3	6.4
CENTER SUPPORT	43.0	41.4	40.7	39.9	39.1	38.2
DRUM DEPLOY ACTUATORS	1.3	1.3	1.3	1.3	1.3	1.3
SLIP RING ASSEMBLY	13.1	13.1	13.1	13.1	13.1	13.1
LEADING EDGE MEMBERS	5.4	5.2	5.2	5.1	5.1	5.0
DRUMS	31.2	30.6	30.3	30.0	29.7	29.3
LATCHES	.3	.3	.3	.3	.3	.3

APPENDIX F

APPLICATION OF DATA TO A TYPICAL MISSION

CONTENTS

APPENDIX F

APPLICATION OF DATA TO A TYPICAL MISSION

It will be assumed that a hypothetical mission has the following design requirements:

Power	20 kW/wing
Area width	4 m (157 in.), unbroken
Position boom length	5 m (197 in.)
Wing frequency	≥0.04 Hz

Assume that a preliminary layout of the design shows a position boom with the following properties:

Bending stiffness $\overline{EI}_p$	2.0×10^6 lb-in.^{2}
Torsion stiffness $\overline{GJ}_p$	1.5×10^6 lb-in.^{2}
Boom weight, W_p	8.7 lb

The designer has provided the following relationship between boom stiffness and boom weight:

$$7.0 \times 10^6 \geq \overline{EI}_p \geq 3.2 \times 10^6 \qquad W_p = 0.280 \times 10^{-5}\ \overline{EI}_p$$
$$3.2 \times 10^6 \geq \overline{EI}_p > 1.5 \times 10^6 \qquad W_p = 0.437 \times 10^{-5}\ \overline{EI}_p$$
$$1.5 \times 10^6 \geq \overline{EI}_p \geq 0.6 \times 10^6 \qquad W_p = 0.777 \times 10^{-5}\ \overline{EI}_p$$

$$5.5 \times 10^6 \geq \overline{GJ}_p > 2.5 \times 10^6 \qquad W_p = 0.395 \times 10^{-5}\ \overline{GJ}_p$$
$$2.5 \times 10^6 \geq \overline{GJ}_p > 1.1 \times 10^6 \qquad W_p = 0.567 \times 10^{-5}\ \overline{GJ}_p$$
$$1.1 \times 10^6 \geq \overline{GJ}_p \geq 0.5 \times 10^6 \qquad W_p = 1.01 \times 10^{-5}\ \overline{GJ}_p$$

The units are lb-in.^{2} for $\overline{EI}_p$ and $\overline{GJ}_p$ and lb for W_p.

It is desired to find a combination of array and position boom combination to minimize the total wing weight.

I. Selection of Foldout Array

As a first try, select a foldout array with a frequency $f_a = 0.05$ Hz, $\omega_a = 0.314$ rad/sec. The desired system frequency is $f_s = 0.04$ Hz, $\omega_s = 0.251$ rad/sec.

A conservative assumption will be made, namely, that it is not known if the lowest frequency for the foldout array is a bending mode or a torsion mode. From Figure 6(c) the array mass is determined as:

$$M_a = \frac{20}{0.0475} = 421 \text{ kg}$$

$$W_a = 926 \text{ lb}$$

The array system bending frequency can now be estimated using Equations (17), (18), and (19):

$$\frac{m_a}{m_p} = 0.996$$

$$\omega_p = 0.807 \text{ rad/sec}$$

$$\omega_s^B = 0.314 \text{ rad/sec}$$

$$f_p = 0.13 \text{ Hz}$$

$$f_s^B = 0.05 \text{ Hz}$$

It is seen that the chosen position boom is stiff enough in bending to not affect the array bending frequency.

For torsion an estimate must be made of the array moment of inertia about the boom centerline. A thin plate will be assumed:

$$I_a \approx \frac{1}{12} (926) \ (157)^2 = 1.9 \times 10^6 \text{ lb-in}^2.$$

Then, using Equations (20) and (21),

$$\omega_T = 1.487 \text{ rad/sec}$$

$$\omega_T^s = 0.307 \text{ rad/sec}$$

$$f_T = 0.236 \text{ Hz}$$

$$f_s^T = 0.049 \text{ Hz}$$

The system weight for the above iteration is 926 + 8.7 ≈ 935 lb. The above choice is too conservative. Either the array frequency can be lowered or the boom stiffness can be reduced.

Case 1. Lower Array Frequency

For the second step, the array frequency has been lowered to

$$f_a = 0.045 \text{ Hz}$$

keeping a constant position boom design. Then

$$W_a = 880 \text{ lb}$$

$$f_s^B = 0.045 \text{ Hz}$$

$$f_s^T = 0.044 \text{ Hz}$$

for a system weight of 889 lb. If the array frequency is lowered to

$$f_a = 0.041 \text{ Hz}$$

keeping a constant position boom design, then

$$W_s = 849 \text{ lb}$$

$$f_s^B = 0.041 \text{ Hz}$$

$$f_s^T = 0.0405 \text{ Hz}$$

for a system weight of 858 lb.

Since $f_s^T \approx 0.04$ Hz, the required system frequency, no more iterations are required, and an array design whose frequency is 0.041 Hz will satisfy the requirements with a position boom as designed.

Case 2. Lower Position Boom Stiffness

The array frequency will be kept constant at 0.05 Hz but the position boom stiffness will be lowered by 65%. Thus,

$$\overline{EI}_p = 0.6 \times 10^6 \text{ lb-in.}^2$$

$$\overline{GJ}_p = 0.5 \times 10^6 \text{ lb-in.}^2$$

$$W_p = 4.7 \text{ lb}$$

This combination yields

$$f_s^B = 0.05 \text{ Hz}$$

$$f_s^T = 0.044 \text{ Hz}$$

for a system weight of 931 lb.

Array Properties

Comparing Case 1 and Case 2, it is clear that it is more weight effective to lower the array frequency than to lower the position boom stiffness. Some additional weight savings may be realized by stiffening the position boom and lowering the array frequency below the required 0.041 Hz as calculated in Case 1.

The array properties can now be found by entering the data table in Appendix E for a foldout array of 20 kW/wing and 4 meters width. It is seen that data for the array frequency of 0.041 Hz are not available. Linear interpolation between the listed frequencies of 0.037 Hz and 0.046 Hz yields the following characteristics for the foldout arrays:

Array weight	847.7 lb
Bending frequency	0.041 Hz
Torsion frequency	0.238 Hz
Blanket tension	35.4 lb
Boom diameter	25.3 in.
Canister height	85.4 in.
Boom weight	219.2 lb
Canister weight	116.9 lb
Blanket weight	416.0 lb
Container weight	38.3 lb

It should be noted that the above characteristics are derived in an approximate fashion by linear interpolation. Some of the variables, such as blanket tension, do not vary linearly and can better be approximated by plotting blanket tension vs frequency for the range of interest and thus improving the accuracy.

It should, furthermore, be noted that the lowest array frequency has been used for estimating both the system bending and torsion frequencies. If these become known, such as from interpolation from the

data of Appendix E above, further iterations using these data may result in less conservative, more weight effective designs.

II. Selection of Rollout Array

The procedure duplicated the steps taken for the foldout array. As a first try, an array with a frequency of $\bar{f}_a = 0.05$ Hz, $\omega_a = 0.314$ rad/sec is selected. Again, the assumption will be made that it is not known if the lowest frequency for the rollout array is a bending or torsion mode. From Figure 8(c) the array mass is determined as

$$M_a = 104.2 \text{ kg}$$

$$W_a = 229.2 \text{ lb}$$

The array bending frequency can now be estimated using Equations (17), (18) and (19):

$$\frac{M_a}{M_p} = 0.983$$

$$\omega_p = 1.612 \text{ rad/sec}$$

$$\omega_s^B = 0.314 \text{ rad/sec}$$

$$f_p = 0.26 \text{ Hz}$$

$$f_s^B = 0.05 \text{ Hz}$$

The position boom has very little effect on the system bending frequency. The array moment of inertia about the boom is estimated as

$$I_a = \frac{1}{12}(229.2)(157)^2 = 4.7 \times 10^5 \text{ lb-in.}^2$$

Then, using Equations (20) and (21),

$$\omega_T = 2.44 \text{ rad/sec}$$

$$\omega_T^s = 0.311 \text{ rad/sec}$$

$$f_T = 0.39 \text{ Hz}$$

$$f_s^T = 0.0497 \text{ Hz}$$

The system weight for the above is

$$229.2 + 8.7 = 238 \text{ lb}$$

Again, the above choice is too conservative. Either the array frequency can be lowered or the position boom stiffness can be reduced.

<u>Case 1.</u> Lower Array Frequency

For the second step the array frequency has been lowered to

$$f_a = 0.041 \text{ Hz}$$

keeping a constant position boom design.

Then,

$$W_a = 217.3 \text{ lb}$$

$$f_s^B = 0.041 \text{ Hz}$$

$$f_s^T = 0.0396 \text{ Hz}$$

for a system weight of 226 lb.

Since $f_s^T \approx 0.04$ Hz, the required system frequency, no more iterations will be performed and an array design whose frequency is 0.041 Hz will satisfy the requirements with a position boom as designed.

<u>Case 2.</u> Lower Position Boom Stiffness

The array frequency will be kept constant at the original estimate of 0.05 Hz but the boom stiffness will be lowered to

$$\overline{EI}_p = 0.6 \times 10^6 \text{ lb-in.}^2$$

$$\overline{GJ}_p = 0.5 \times 10^6 \text{ lb-in.}^2$$

$$W_p = 4.7 \text{ lb}$$

This combination yields

$$f_s^B = 0.05 \text{ Hz}$$

$$f_s^T = 0.0492 \text{ Hz}$$

for a system weight of 234 lb.

Here, again, it is more advantageous to lower the array frequency than to decrease boom stiffness. Some additional weight savings may be realized by stiffening the position boom and lowering the array frequency below the required 0.041 Hz as calculated in Case 1. The array properties can now be found by entering the data display in Appendix E for a rollout array of 20 kW/wing and 4 meters wide. Data for an array frequency of 0.041 Hz is not available. Interpolation between given values will be required. Linear interpolation between the frequencies of 0.039 Hz and 0.046 Hz yields the following characteristics for the rollout array:

Array weight	222.2 lb
Bending frequency	0.084 Hz
Torsion frequency	0.041 Hz
Blanket tension	8.3 lb
Boom diameter	14.3 in
Canister height	43.4 in.
Boom weight	27.9 lb
Canister weight	30.0 lb
Blanket weight	122.0 lb
Shaft weight	1.2 lb

It should be noted that the above characteristics are derived in an approximate fashion for linear interpolation. Some improvement can be achieved by plotting the available data rather than using linear interpolation. The lowest array frequency has been used for both bending and torsion. These estimates may be improved by using the values for the lateral torsion and bending frequencies.

III. Comparison of Foldout vs Rollout

For the same basic system requirement the foldout system weight was estimated at 858 lb. The rollout system weight is 234 lb. Different solar cell technology accounts for the majority of the differences.

C-7

APPENDIX REFERENCES AND BIBLIOGRAPHY

1. Ritchie, D. W., and Sandstrom, J. D., "Multikilowatt Solar Arrays", Technical Report 32-1140, Jet Propulsion Laboratory, Pasadena, California, July 15, 1967.

2. Evaluation of Space Station Solar Array Technology and Recommended Advanced Development Programs, First Topical Report, Lockheed Missiles and Space Company Report LMSC-A981486, December, 1970.

3. Design and Analysis, Space Station Solar Array Technology Evaluation Program, Second Topical Report, Lockheed Missiles and Space Company Report LMSC-A995719, November 1971.

4. Design Support, Major Hardware, and System Level Testing, Third Topical Report, Lockheed Missiles and Space Company Report LMSC-D153526, September, 1972.

5. Design Data Handbook for Flexible Solar Array Systems, Space Station Solar Array Technology Evaluation Program, Lockheed Missiles and Space Company Report LMSC-D159618, March, 1973.

6. Solar Array Flexible Substrate Design Optimization, Fabrication, Delivery and Test Evaluation Program, Lockheed Missiles and Space Company Report LMSC-D304284, March 1975.

7. Rollup Subsolar Array, Final Report, General Electric Space Systems Organization Report GE-SSO-7050 4286, February 1, 1971.

8. Hasbach, W. A., and Ross, R. G., "Summary Report on the Development, Design and Test of a 66 W/kg (30 W/lb) Solar Array", Technical Report 31-1562, Jet Propulsion Laboratory, Pasadena, California, September 15, 1972.

9. Feasibility Study of a 110 Watt Per Kilogram Lightweight Solar Array System, General Electric Space Systems Organization, Report 73 SD 4256, May 25, 1973.

10. Oliver, R. E., Garba, J. A., and Hix, J. H., "A Parametric Study of Variations in Weight and Performance Characteristics of Large-Area Solar Arrays", Technical Report 32-1337, Jet Propulsion Laboratory, Pasadena, California, March 1, 1969.

11. Coyner Jr., J. V. and Ross Jr., R. G., "Parametric Study of the Performance Characteristics and Weight Variations of Large-area Roll-up Solar Arrays, Technical Report 32-1502, Jet Propulsion Laboratory, Pasadena, California, December 15, 1970.

12. "Solar Array Technology Development for SEP", Mid-Term Report, Lockheed Missiles and Space Company Report LMSC-D492693, 18 January 1977.

13. "Extended Performance SEP Solar Array Study", Final Report, Lockheed Missiles and Space Company, Report LMSC-D573740, 19 July 1977.

14. "Conceptual Approach Study of 200 Watt Per Kilogram Solar Array", Final Report, General Electric Space Division Report 77 SDS 4207, 31 August 1977.

15. "Solar Array Conceptual Design for the Halley's Comet Ion Drive Mission", Final Report, General Electric Space Division Report SDS 4243, 31 August 1977.

16. Zak, M., "Snaps in Structures", Paper to be Presented at the 49th Shock and Vibration Symposium Naval Research Laboratory, Washington, D.C., October 17-18, 1978.

17. Zak, M., "Non-Linear Phenomena in Films of Solar Arrays", Paper to be Presented at the 20th AIAA/ASME/ASCE/AHS Structures, Structural Dynamics and Materials Conference, St. Louis, Missouri, April 4-6, 1979.

18. Zak, M., "Non-classical Problems in Continuum Mechanics", Monographs (In Russian), Leningrad, USSR, 1974.

19. Zak, M., "Dynamics of Films" to be Published in the Journal of Elasticity, Noordhoff International Publishing.

20. Ross Jr., R. G., Personal Notes, Appendix B of General Electric Final Report on the Design and Development of a 30 Watt Per Pound 200 Square Foot Rollup Solar Array, Entitled "Deviation of Boom Characteristic With Tip Constraint.

21. Design Data for Negator Constraint Force Springs, Bulletin SDD6-7, AMEREK, Hatfield, Pennsylvania, 1977.

22. Frank, Irving and Gray, Edward, "Temperature Distribution in Long Cylindrical Shells", ASME Journal of Heat Transfer, Vol. 84, May 1962, pp. 190-191.

23. Hamilton, D. C., and Morgan, W. R., "Radiant Interchange Configuration Factors NACA TN 2836, 1952, Configuration P-2, pp. 23 and 35-36.

24. Bamford, R. M., Wada, B. K., and Gayman, W. H., Equivalent Spring-Mass System for Normal Modes, Technical Memorandum 33-380, Jet Propulsion Laboratory, Pasadena, Calif., February 15, 1971.

25. Wada, B. K., Bamford, R., and Garba, J. A., "Equivalent Spring-Mass System: A Physical Interpretation," The Shock and Vibration Bulletin, Bulletin 42, Part 5, Naval Research Laboratory, Washington, D.C., January, 1972, pp. 215-225.

26. Costogue, E. N., Young, L. E., and Brandhorst, High-Power, Ultralow-Mass Solar Arrays: FY77 Technology Readiness Assessment Report, JPL Publication 78-48, Vols. I and II, Jet Propulsion Laboratory, Pasadena, Calif., June 15, 1978.

JPL PUBLICATION 78-95